UNIVERSITY OF MICHIGAN
APR 15 1956
FORESTRY LIBRARY

DEVELOPMENT IN THE TROPICS

WORLD CROPS

embracing

AGRONOMY, HANDLING, PROCESSING, STORAGE AND PROTECTION
SOILS, CHEMICALS, IRRIGATION, ENGINEERING AND ECONOMICS

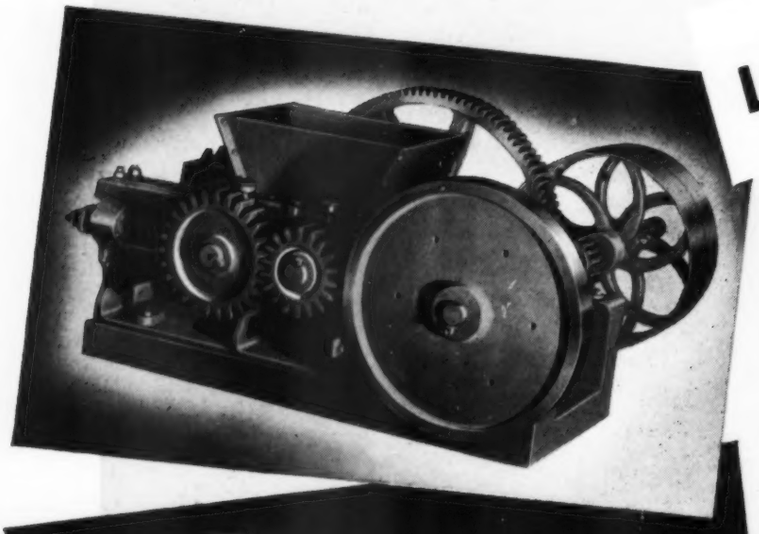
VOLUME 8, No. 5 **MAY 1956**

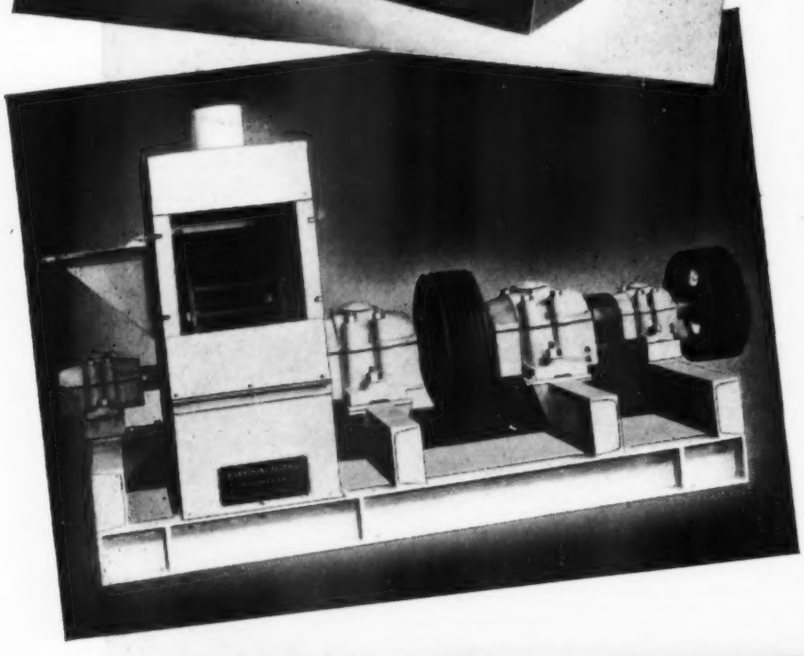
A Publication of The Leonard Hill Technical Group

Dusting rubber with Cuprosana R.6 against phytophthora in Southern India

GRINDING?

LEAVE IT TO US!





Our research and development organisation is always ready to tackle your particular job. If you have a crushing or grinding problem, consult J. Harrison Carter—we've been experts in this field for over half a century.

J. Harrison Carter offer a wide range of DISINTEGRATORS, CRUSHERS, GRINDERS, MIXERS, EDGE RUNNER MILLS. Machinery for manufacturers of: Agricultural Chemicals, Bone Meal, Bone Flour, Animal Feed.

Top: Heavy Duty Crusher
Left: Bar Type Disintegrator

J. Harrison Carter Ltd

DUNSTABLE · BEDS · ENGLAND
TELEPHONE · DUNSTABLE 1191/2

WORLD CROPS

Vol. 8, No. 5 MAY 1956

CONTENTS

EDITORIAL COMMENT:

Commonwealth Agricultural Bureaux; Aerial Application; Come Again Another Day; Chinese Reclamation Project; DDT, BHC and Worms; Rain and the Plant's Nutrients; Polish Agricultural Policy; France Frappée; Plus Sun and Minus Rabbits; Hedgerow Timber as a Crop; Soviet Farm Programme 169

Small-Scale Farming in the West Indies—*A. L. Jolly*, PH.D.(LOND.), M.A., M.SC. ... 173

Pacific Subsistence Crops: Sago—*Emile Massal and Jacques Barrau* 177

There in the Jungle Malaya's Cacao Grows—*Warner Vanter* 180

Mexican Agricultural Prosperity 183

Agricultural Developments in Fiji—*W. J. A. Payne and R. R. Mason* 187

Japanese Experience in Protective Planting—*Masataka Ohmasa* 192

Desert Locust Situation, 1954-55—*O. B. Lean* 196

Kenya Citrus Orchard Blossoms 199

Correspondence 201

New Publications 204

Machinery and Equipment 207

World Crop Reports 211

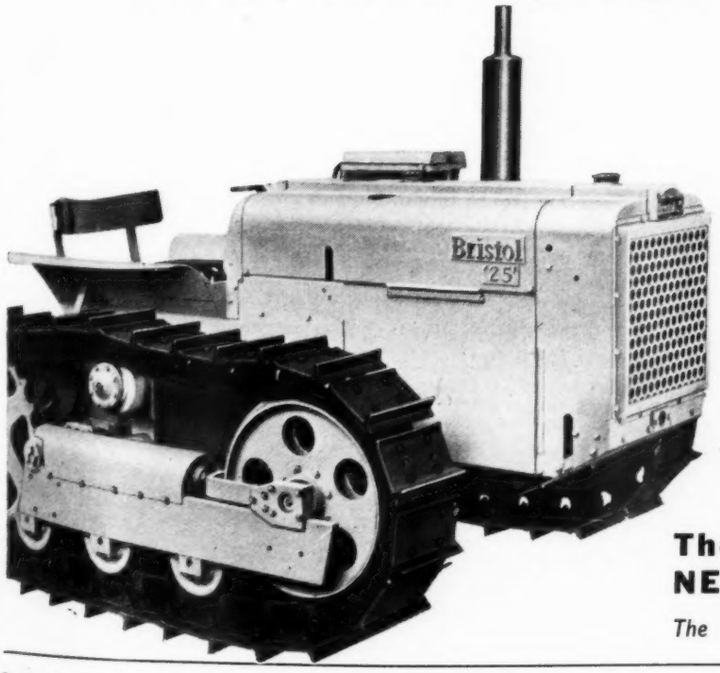
For some years past large areas of rubber in Southern India have been economically dusted with Cuprosana R.6, with successful results against secondary leaf fall, caused by Phytophthora. The picture on the front cover shows this work in progress. For further information on the above and other agricultural chemicals please apply to: **Universal Crop Protection Ltd., 22 Marshgate Lane, Stratford, London, E.15. Telephone: MARyland 4577. Cables: Unicrop, London.**

Sole Agents in Ceylon and South India: **Messrs. Harrisons & Crosfield Ltd., P.O. Box 4, Cochin 1, Malabar, South India; P.O. Box 69, Prince Buildings, Colombo, Ceylon.**

Published monthly by Leonard Hill Limited, Stratford House, 9 Eden Street, London, N.W.1, England (Tel. Euston 5911)

Your land hilly? Grow row-crops? Reclaiming?

—you need this NEW lightweight power-packed crawler



Work slopes that no wheeled tractor can tackle—in complete safety—up and down, *and across*—with this new, better Bristol '25'. The *new* Bristol '25' does every on-the-farm job. Its 2-ton drawbar pull makes light work of two- and three-furrow ploughing, land clearing, timber extraction—every job that calls for real power. Its manœuvrability and accurate steering make it equally useful in close, row-crop work. This powerful *new* crawler has all-steel, trouble-free tracks, ground pressure of only 4½ lbs. per sq. in., economical Diesel or V.O. engine, etc. Write at once for free, fully-illustrated catalogue.

The NEW BRISTOL '25'

The lightweight crawler with the heavyweight pull

BRISTOL TRACTORS LIMITED · EARBY · VIA COLNE · LANCASHIRE

After Coffee...

TEA

Before Ceylon became famous for its tea—it was famous for its coffee. Early in the 1800s the steep green slopes of the island's hill jungle were cleared and cultivated by coffee planters, mostly Scots, and coffee soon became the major crop. Then in 1869 came disaster: a devastating blight attacked the trees and within a few years the whole industry was wiped out. So the resourceful Scots planted tea instead....

But the tea bushes of Ceylon have constantly to be protected against diseases — among them Blister Blight. Here the problem was not to find a fungicide — a copper compound was known to be effective — but to develop a technique of spraying the bushes so that the fungicide could penetrate and do its job. Plant Protection Ltd was called in and, in collaboration with the Tea Research Institute, they evolved a technique of low-volume spraying which proved completely satisfactory.

Devising new spraying techniques is only part of the Plant Protection service to farmers and growers.
The real basis of this service is the research on fungicides, insecticides and weedkillers carried out by the parent Company, Imperial Chemical Industries Limited, and at Plant Protection's Fernhurst Research Station. This ensures that Plant Protection products are as effective and reliable as modern science can make them.

PLANT PROTECTION LTD

Editorial Comment

Commonwealth Agricultural Bureaux

THE report of the proceedings of the Commonwealth Agricultural Bureaux Review Conference, held in London from 8 June to 6 July, 1955, (H.M.S.O., Cmd. 9664, 4s. 0d.) forms a valuable appraisal of the work and usefulness of these institutes and bureaux. One of the main conclusions of the conference was that the organisation provides an information service on scientific work in agriculture and forestry throughout the world that is of vital importance to agricultural development, and thus for the production of food and the maintenance of living standards. It also concluded that this comprehensive service is unique, and could not be provided by either national or international organisations so cheaply or so efficiently, the cost of the service being very small in relation to the value of agricultural and forestry production in the contributing countries.

These conferences normally take place every five years. Three previous meetings have been held — in 1936, in 1946 and in 1950—and an interim review was made during the war years by a committee under the chairmanship of Lord Hankey in 1943.

The Commonwealth Agricultural Bureaux Organisation is the result of growth and adaptation. Beginning over 46 years ago in the field of entomology, it has expanded its services to all branches of agricultural science and forestry, and is today one of the best of the many examples of organisations helping scientists in Commonwealth countries to contribute to the solution of problems, both within the Commonwealth and the world as a whole. The organisation became known as the Commonwealth Agricultural Bureaux on 1 January, 1948, this title being thought to represent more accurately the free association of participating Governments.

The institutes and bureaux collect their information by the constant scrutiny of scientific literature in all languages. The information is then classified and the essence of it published in the indexed abstract journal which each one issues. This regular service is supplemented by occasional publications giving reviews of published work on particular problems or experiments, and by answering inquiries from scientists.

Among other things, the 1955 conference recommended that a grant be made to the U.K. National Institute of Agricultural Engineering, at Silsoe, Bedfordshire, for strengthening the abstracting and information service in that subject. It also recommended that the question of establishing a Bureau of Agricultural Engineering be included in the agenda at the next conference.

Aerial application

RANGELANDS can be fertilised 20 times faster with aeroplanes than with ground implements. According to A. H. Murphy, of the University of California Hopland Field Station, 140 acres of rough, rolling range at the station were completely fertilised by aeroplane in four hours. With ground implements it would have taken at least 10 days and then the coverage would not have been complete because of the rough, steep terrain. Mr. Murphy says an aerial application of 300 lb. of 16–20 nitrogen–phosphorus fertiliser per acre costs about one cent a pound.

When range is broken, rocky or covered with trees, aeroplanes are the most feasible method of applying fertiliser. He says, however, that the size of the range to be fertilised and the distance from the nearest airstrip have to be considered before deciding on aerial fertilisation.

Come again another day

RAINFALL can be increased by so-called 'cloud seeding' techniques, the first U.S. scientific report on the subject affirms. The report has been issued by a Committee on Weather Control appointed by President Eisenhower. The committee concludes that it is feasible for human agents to increase rainfall by 9–17% or more. It also suggests that experiments have shown it may be possible to control hail storms, modify tornadoes and restrict the danger of lightning storms.

Referring specifically to the technique of seeding clouds with silver iodide smoke from generators on the ground, the report says (according to the *Financial Times*) the results, while not spectacular, 'can be very important to the water economy of the nation'. Man does not actually generate rain, but he increases the amount of precipitation where favourable conditions exist. In some instances an increase of only 1% in rainfall would benefit agriculture, it is pointed out. Statistics as yet unevaluated could conceivably show increase even above the top figure of 17%.

The 9–17% increase figure emerges from a study of five cloud-seeding operations in the Pacific coast area of America. Other studies have provided no conclusive evidence that such methods can reduce the amount of rainfall, but they do indicate 'almost absolute suppression of hail'. Noting that the conditions which produce hail also frequently generate lightning, the report suggests that success with hail suppression could also reduce the incidence of lightning storms, a frequent cause of forest fires in America. Such research might also produce results that might be applied to controlling tornadoes.

Chinese reclamation project

A VAST project for the development of some 74 million acres of waste land in China will probably have political effects as great as the economic gains that are anticipated. According to a recent announcement in Peking, China is planning to develop the land in a number of five-year plans, which will increase the country's annual grain output by 50 million tons. Most of this waste land is in the north-east, north-west and south-west.

During the past three years about five million acres of waste land have been reclaimed in China. A number of youth reclamation corps have been formed throughout the country and many thousands of youths are reported to be working ' from Heilungkiang in the far north to Hainan in the tropical south '. Many of these youths are said to have been sent from cities and most of them are unused to manual labour. There can be no doubt that the movement of people into the sparsely populated border areas will have great economic and political effects. Many of these places will inevitably become prosperous as the populations increase and the land comes into use.

Heilungkiang, where extensive reclamation is taking place, is already a large grain-producing area.

One vast area, on which work has already begun, is the large tract in the far north that lies between the railway and the River Amur. This area includes a large bulge of wild and almost unknown territory. Other areas awaiting development include the great grasslands of Kansu province and western Szechuan.

DDT, BHC and worms

THE use of insecticides of the chlorinated hydrocarbon class—DDT, crude BHC or refined gamma-BHC—in controlling the common grass grub in pastureland has rapidly increased in New Zealand. This is causing some concern about the effect of these chemical substances on beneficial organisms, particularly the earthworm. Whatever may be the pros and cons of the earthworm's contribution to tilled soil cropping, there can be little doubt that it is one of usefulness in grassland, both for aeration of the topsoil layer and for organic matter ' handling '. Rather strangely, modern agricultural research literature has little to say about the toxicity of DDT or BHC to earthworms. The older-known natural insecticide, derris, can be powerfully toxic to earthworms—it is one of the several anti-worm additives for lawns. However, the derris effect is said to be somewhat inconsistent.

A recent New Zealand paper (*N.Z. J. Sci. Tech.*, 1955, [A] **37**, 367) describes laboratory and field tests investigating the effects of DDT and BHC on grass earthworms. There is little doubt that these substances exercise a deterrent effect upon earthworms but the effect does not seem to be significant unless abnormally heavy rates of application are given. Populations showed reduction 23 and 83 weeks after DDT or BHC applications when dressing rates 10 times the normal amount for grub control were given, but at the usual dressing rate population figures for treated and untreated plots differed very slightly. Perhaps somewhat surprisingly, in view of BHC's greater volatility, the toxic effect of DDT was less persistent than that of BHC.

However, there appears to be no risk to the ordinary earthworm in ordinary practice. Up to two pounds per acre of the active isomer of DDT or BHC can be given without measurable decline in worm numbers either quickly or a year and a half later; and for grub control this rate of application is used only once every third year. There is a possibility that DDT or BHC toxicity to worms is rather higher in soils with a low organic-matter content; in such soils, of course, worms are living in an unfavourable environment and their resistance may be poorer. But soils of well-established grassland are unlikely to be poorly supplied with organic matter.

Rain and the plant's nutrients

RESEARCH in which radioisotopic tracers were used has shown that rain can wash nutrients out of plant foliage as well as out of the soil. At Michigan State University 71 % of the potash in plant leaves was washed out by four hours of simulated rainfall. It was also shown that nitrogen, calcium, magnesium, boron, manganese, iron and copper may be washed out by rain. That this is a possibility has often been considered, but experimental proof has not previously removed the idea from the field of speculation. Even now many agricultural scientists will want more proof than that of a single series of tests at one centre. For the result raises a number of very salient points. If heavy rain reduces the plant-food content of foliage, albeit temporarily, serious queries are presented for modern tissue-testing as a means of assessing plant-food needs. Is this type of leaching, in fact, a loss of plant food? For when it occurs the removed nutrients reenter the soil close to the plant and will presumably be in soluble and therefore available form; for shallower rooted crops a fairly speedy return of the lost nutrients can probably be presumed. However, for trees, from which a seriously heavy loss of foliage nutrients could occur, the return *via* the soil would be much slower and serious deficiencies at critical times in the growing season could result.

One sidelight on this new research item is the doubt it throws upon some South African experimental work of a few years ago. This indicated that mineral nutrients

were absorbed through foliage from the air, from clouds of 'aerosol' particles. Absorptive papers hung from trees in leaf-like positions showed a gain in mineral nutrients. However, to show measurable gains these papers had to be exposed for lengthy periods, and it now seems more probable that the nutrients they acquired came from rainfall 'washings' from adjacent leaves. These papers would certainly absorb any nutrient solutions formed by rainfall-foliage contact as and when drops fell on them.

Polish agricultural policy

POLAND'S new agricultural policy, which has just been decided by the Polish Communist Party's Central Committee, allots private farmers the task of continuing to produce the 'overwhelming mass' of foodstuffs during the current State Five-Year Plan (1956-60). Not more than one in three acres will be farmed collectively when the State plan has run its course.

The Party and Government will continue to extend greater production assistance to individual farms but at the same time help will be given to co-operative farms to promote collective farming. It is estimated that by 1960, collective farming will extend over 25–30% of the total peasant area.

Agricultural production, the Party has decreed, will increase by 24% in the next five years. In 1960, Poland is to harvest 14,200,000 tons of grain, 38 million to 39,800,000 tons of potatoes and 9 million to 9,400,000 tons of sugar-beet. To this end, average yields have to be raised by some 14% and the area under cultivation by some 500,000 ha. to 15,750,000 ha.

Three times as many agricultural machines are to be produced by Polish industry in order to raise the national tractor pool to 112,000 units (in terms of 15 h.p.) and that of combine harvesters to 14,000 by 1960.

According to the Polish news agency PAP, the Central Committee has decreed that between 30,000 million and 32,000 million zlotys be allocated for investments in agriculture during the next five years. The Committee stresses that the most important task in the socialist transformation of the countryside is to achieve a systematic development of co-operative farming throughout the country.

France frappée

THE record cold spell which hit France and the rest of Europe in February, freezing the soil in parts of France to a depth of 50 cm., has been a serious financial blow to thousands of small French farmers, but is not a national disaster in the sense that the economy of the nation as a whole will be seriously hurt over a long period, reports the European edition of the *New York Herald Tribune*.

André Dulin, Secretary of State for Agriculture, said recently that the total losses to French farmers are estimated in the neighbourhood of 200,000 million francs ($570 million), but technicians in the Ministry of Agriculture say that this is a generous figure and will probably turn out to be an over-estimation.

But as far as the general public is concerned, the disaster is temporary and not too serious. With the advent of warm weather farms south of the Loire are expected soon to provide the markets with a new crop which will quickly bring prices down to normal.

Ministry of Agriculture officials said that, with the possible exception of some forage for cattle, owing to damage to pasturelands, France will not need to import any foodstuffs on an emergency basis this year. There is enough food for everyone and Government measures of tax reduction and the like are expected to hold the cost of living in line. Export commitments, too, will be met.

The most serious damage of the freeze was to the winter wheat crop. Losses to farmers are estimated anywhere between 25 million and 35 million quintals (1 quintal equals 220.46 lb.). As the farmer receives 3,400 francs per quintal for his wheat from the Government, this represents a loss of 75,000 million to 119,000 million francs.

The heavy loss was explained by experts at the Department of Agriculture as due to the fact that the freeze was so sudden, and the soil so saturated with water when it came, that the ground froze sometimes to a depth of 50 cm., killing even the deep roots. Usually, they said, the ground has a chance to dry out gradually before freezing to a depth of 5 to 10 cm.

Officials at the Ministry of Agriculture said that it was not possible even to gauge accurately the extent of the losses in all branches of agriculture at this stage, let alone the financial results. But they are confident that no serious disruptions of the country's internal or external economic pattern need be feared.

Plus sun and minus rabbits

THE final estimates of 1955's crop production in England and Wales have confirmed that cereal yields were the highest ever recorded. The actual figures, with some comparisons, are worth restatement here:

Crop	*Average Yield per Acre (cwt.)*		
	10-year average 1945-54	*Previous best,* 1953	1955
Wheat	20.8	24.0	26.7
Barley	19.5	22.6	25.4
Oats	18.2	21.2	22.5

Too many people have attributed these better yields entirely to the absence of rabbits. Myxomatosis undoubtedly made its contribution, but not for many

years of memory has there been a sunnier growing season for cereals. If rainfall was scarce in the rather later growing season for root crops, there was not as much scarcity as in 1947 in the months that matter for wheat and barley. Sunshine was above all the arbiter. How much positive help came from the disappearance of most of the rabbits will be revealed in 1956 or 1957, for Britain cannot hope for as much sun again in both these years and it is improbable that rabbits will return in huge numbers by then even if some signs of myxomatosis resistance have been observed.

Yet there is one reflection upon these record figures of *average* yield that should not be glossed over. To quite a number of skilled, specialised farmers in this country 26.7 cwt. of wheat grain per acre would be a poor yield in a season of only moderately helpful weather. Yields of between 34 and 40 cwt. are by no means uncommon where modern varieties are sown and when the utmost use is made of fertilisers. Then record averages—aided by somewhat fortuitous conditions—still lag well behind the standard that science plus management can achieve under ' every-year ' conditions. It is true that the national average must always include results from marginal soils and poor farming, but the difference at least shows how much room still remains for general improvement. And it is yield per acre that must mainly determine cost of production per hundredweight—so many of the costs per acre are much the same whether a good or poor crop is ultimately harvested.

As to the rather lower yields of root crops, due to the dryness of the second half of summer, there is one interesting fact. The 1955 yield of sugar-beet —10.8 tons per acre—was actually above the 1954 yield of 10.5 tons and also above the average for 1945–54. Yields for potatoes, turnips and mangolds were significantly lower than in 1954 and, except for potatoes, below the 1945–54 average. Largely through the Sugar Beet Corporation's advisory work, sugar-beet in this country has long been recognised as the crop that receives the most liberal fertiliser treatment —for no other crop is the average rate of dressing as near the rate that science would recommend. Is it not for this reason that sugar-beet yields showed a smaller decline?

Hedgerow timber as a crop

HEDGEROW and farm trees should be treated as a crop and a long-term investment, according to the committee appointed by the Minister of Agriculture and the Secretary of State for Scotland to inquire into the best means of securing the planting and tending of hedgerow timber (Report of the Committee on Hedgerow and Farm Timber, 1955, H.M.S.O., 3s. 6d.).

The planting and tending of hedgerow trees is generally acknowledged by farmers to be contrary to good agricultural practice, particularly on arable land. There can be no justification for planting and maintaining trees which would prevent the best use of land for the production of food. The committee, however, although recognising that fact, state that timber which can be produced without such ill effects is of value to the owner and to the nation.

It is possible, say the committee, for hedgerow trees, properly sited and maintained, to be grown on the borders of arable fields without any apparent detriment to crops. Indeed, they recommend that this kind of planting should be widely carried out, especially in the Fens and in other flat arable country.

Recommending that all concerned with the management of agricultural land should increase their stock of hedgerow and farm timber, the committee suggest that attention should be given to the more careful use of mechanical hedgecutters in trimming hedgerows. Where it is necessary to fell hedgerow trees, the hedgerows should, they say, be retained so far as possible.

The committee also recommend that further research should be made into the possibilities of using forest trees in arresting coastal erosion and in the stabilisation of sand dunes to prevent flooding by the sea.

Soviet farm programme

A PROGRAMME for increasing farm production for the State has been announced by the Soviet Union. Without doubt, this is a drive to reform Soviet farming, for under the programme privately owned plots on collective farms will be gradually eliminated.

Soviet farmers will in future receive most of their income from work on the communally owned farms. They will receive money advances each month up to a half of the value of the proceeds to be obtained from their deliveries and sales to the State. This system, it is claimed, will satisfy all the needs of farmers from collective production. The communal output, says the Union, has already grown to such an extent on many farms that the farmers ' are not interested in having a personal subsidiary economy to the extent provided by the original charter '. Hitherto many farmers, particularly those on the poorer land, have had to wait until the end of the agricultural year before seeing the result of their work on the collective farms.

According to the announcement, the allotments of livestock to a family are no longer necessary for survival.

Under the new system farms will be allowed to set their own output norms and remuneration for labour instead of having their economy regulated from Moscow or regional centres. These norms, however, must take account of any increased mechanisation of the farm as well as special local conditions.

SMALL-SCALE FARMING IN THE WEST INDIES

A. L. JOLLY, PH.D.(LOND.), M.A., M.SC.

(*Lecturer in Economics, Imperial College of Tropical Agriculture, Trinidad*)

If the changes outlined in this paper could be achieved in the next generation, it would create an economic, agricultural and social revolution in the West Indies. These are the words of Dr. Jolly, who considers that such a revolution is possible provided the economic investigations required to provide the fundamental information are conscientiously carried out and the initial settlements required to apply the proven systems are firmly directed.

SMALL farmers in the West Indies have been the hope and, at the same time, the despair of agricultural experts for generations. The hope they represent is the hope for more diversified agriculture and particularly an agriculture less dependent on the export of sugar; for a West Indies that would, therefore, be to a larger extent master of its own economic affairs and less dependent on those of the sugar-producing and -consuming countries of the world. The hope that numerous and more prosperous small farmers would fill the uncomfortable social gap between the wealthy proprietor and the labourer in islands that are, and are likely to remain, largely agricultural; that they would thereby weld the factions of West Indian society into a solid, viable unit.

Royal Commission

They create despair through their inefficiency as farmers. Whether observed in 1897 or 1939, they were considered the least efficient agricultural producers, in many cases not capable of supporting themselves from their own agricultural efforts even at a labourer's standard of living. The 1939 Royal Commission reported: ' . . . in all (types of peasant agriculture) there is supreme need to ensure greater productivity of the land to get rid of shifting cultivation, to make better use of livestock, and lessening the risk by widening production '.

Partly as a result of the observations of this Commission, more detailed information has been collected about the operation of small farms, particularly in the southern islands of the Caribbean. The general absence of good farming, which is capable of yielding a satisfactory income to the proprietor, was confirmed; so, also, was the dependence of small farmers on wage work and non-agricultural occupations; but the most important findings were the handicaps under which most small farmers operated. These handicaps militated against, and in many cases completely excluded, the possibility of sound agriculture. Many of the most common features of bad farming were attributable directly to these handicaps and not primarily to ignorance or lack of enterprise on the part of the farmer. Indeed, the enterprise of farmers and their ingenuity in minimising their handicaps was often most noticeable.

The commonest handicap of the West Indian small farmer was found to be in respect of his land, which usually appeared to be the poorest in the territory. The poorness of the land was partly due to the fact that the peasant was historically the last and poorest bidder for the limited supply, but also to the fact that his poor farming practices rapidly degraded any land that was originally endowed with superior fertility. The poor quality of the land was not counterbalanced by an adequate area; about 50% of the

Non-residential farming on unsuitable land. The hill in the background rises precipitously to 2,100 ft., but is nevertheless cultivated in small peasant patches

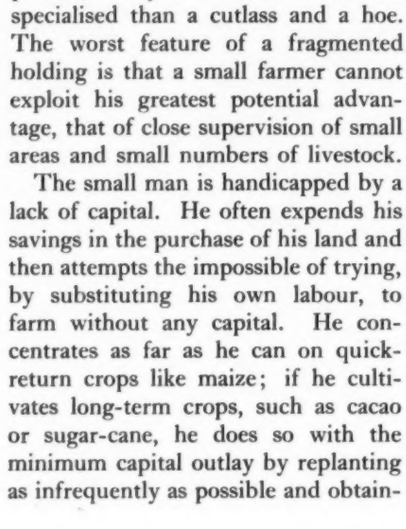
farms in Jamaica fall in the size range 1–4 acres, and in Trinidad peasant farms of more than 10 acres were found to be uncommon. It would require an extremely intensive form of production to secure an adequate living from the cultivation of such small farms and it is little wonder that part-time farming is the almost universal result. The evils of part-time farming are twofold. First, it diverts the farmer's attention from the technical problems of his own farm; a poor crop is not so likely to stimulate his efforts as a farmer as to impress on him the need for taking more outside labouring work to make up the deficiency in income. Second, wage work is most plentiful at the time of the year when the farmer's own crops need the most attention; at that time his own cultivations have only second claim on his labour and suffer accordingly.

Land-tenure systems

The systems of land tenure in the West Indies are notoriously unsatisfactory and constitute a second handicap. Share cropping, insecurity of tenure, the absence of written tenancy agreements, the inadequacy of landlord investment etc. do not encourage a high standard of farming. The apparent irresponsibility of both landlord and tenant is probably attributable to the historical fact that the relationship developed out of depression and not out of prosperity; renting land was often the last resort of the bankrupt planter and his faithful labourer to make some sort of a living, however poor, out of an often derelict plantation. The generally poor standard of farming by tenants becomes the accepted standard for all and the small owner-occupiers often abuse their land as much as tenants do. So long as land is managed in a way that yields only a poor living, so long will it be considered a poor provider, and urban occupations will be more attractive than agriculture.

It is common for these unsatisfactory land conditions to be exaggerated by fragmentation. It is unusual for a small farmer even with only 10 acres to cultivate a compact block; fragmentation is common because few farmers have the funds to buy or lease sufficient land at the outset and so have to build up their farms piece by piece. The fragmentation of holdings severely limits the types of agriculture that can be practised on them. It is usually quite uneconomic to use organic manure on any but the small house-plot; it is almost impossible to grow crops away from the house that cannot easily be stolen and quite impossible to conduct most livestock enterprises on them. The plots away from the house are for this reason largely cultivated in export crops which have no immediate local market. Tools and implements have to be limited in number and confined to those that can be easily transported; they are often no more specialised than a cutlass and a hoe. The worst feature of a fragmented holding is that a small farmer cannot exploit his greatest potential advantage, that of close supervision of small areas and small numbers of livestock.

The small man is handicapped by a lack of capital. He often expends his savings in the purchase of his land and then attempts the impossible of trying, by substituting his own labour, to farm without any capital. He concentrates as far as he can on quick-return crops like maize; if he cultivates long-term crops, such as cacao or sugar-cane, he does so with the minimum capital outlay by replanting as infrequently as possible and obtaining a quick cash return mainly from the labour of harvesting; if he owns any livestock, he feeds them laboriously by cutting wayside grass that nobody wants and not from a labour-saving forage plot planted close to his house. A small farmer should, in relation to the size of his business, have a higher investment in crops and livestock than a large-scale farmer because he has not so much opportunity for investing in power machinery and other special equipment. It has, unfortunately, in the past been only too common for the West Indian farmer to have a negligible and hopelessly inadequate investment in crops and livestock.



The cane in the foreground represents no capital cultivation and is expected to reimburse the peasant merely for the labour of cutting. In the background is a well-cultivated crop which may represent an investment of as much as $300 an acre

Cash economy

It was found to be typical for the West Indian peasant, unlike many of his European colleagues, to rely heavily on a cash economy, to sell most of his produce and buy most of his food. This often deplored characteristic is forced on the West Indian farmer by the dangers of larceny, the difficulty of storing local foods through the year, and the cheapness, durability and ready availability of imported foods. The West Indian's dependence on cash has the advantage of making him a shrewd businessman; the typical peasant prejudices and conservatism are singularly absent among West Indian small farmers. The alacrity with which large numbers of them leave agriculture when opportunity offers for entirely strange urban occupations illustrates shrewd opportunism. The dependence on cash crops has, however, the serious disadvantage that in one locality there is usually one pre-eminently suitable export crop; a dependence on this crop almost to the exclusion of any other by both small and large farmers leads to a seasonal demand for labour. The small farmer is not employed on his holding for a large part of the year and often has to employ extra labour at busy times. A small farmer can never be efficient as an employer because he is in a weak bargaining position *vis-à-vis* the plantation. Furthermore, he reduces the scope for careful, detailed work when he relies partly on an employee.

This depressing catalogue of handicaps is easier to list than to correct. Since the beginning of this century numerous efforts have been made to overcome them in various ways; by

means of land settlements on which settlers are usually provided with compact residential holdings on good terms of tenure; by means of credit schemes, marketing schemes and educational and scientific services. This well-intentioned assistance has, however, been sporadic chiefly because it has evidently not resulted in much improvement in the standard of small-scale agriculture, at least up to the beginning of the last war; the assistance has undoubtedly helped a few farmers, but from the information collected between 1938–44 it had made little difference to the majority. The reason is that rarely did the schemes of assistance remove all the handicaps at once. For instance, many land settlements did not make adequate provision for credit, with the result that the settlers could not take full advantage of their better terms of land tenure; with insufficient capital they were forced to exhaust their land in an effort to make some sort of a temporary living. In the same way credit schemes are not usually restricted to farms that are capable, on account of their size, quality of land and other conditions, of yielding an adequate living if properly capitalised; much of the capital created by this credit is inevitably eaten away in current consumption and does not confer permanent benefit.

Well-grown crops that require high capitalisation like yams are very suitable for peasant cultivation

Change

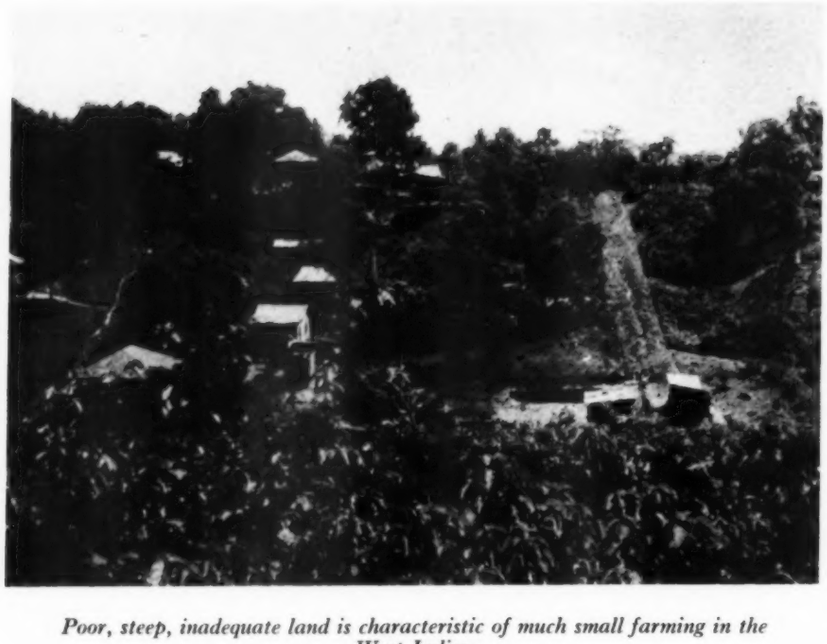
Since the war, however, there has been a noticeable change in small farming. The general prosperity that came to the West Indies during the war and spread afterwards has ameliorated the lot of the peasant considerably. The prices for his export produce have been good and the expansion in many of the islands' economies has improved the market for the few local foods he grows. Increased prosperity has increased urban employment and reduced somewhat the pressure on the land. During the war many small farmers had the unique opportunity of earning what was to him a very large sum of money from usually non-agricultural work; these earnings were sufficient to provide the capital on which he could support himself while rehabilitating his farm after the war, an operation he had never been able so thoroughly to undertake in the days of poverty. The rice growers of British Guiana, the cane farmers of Trinidad and the banana growers of Jamaica are all farming at a considerably higher standard than was previously customary. Evidence is in the increase in production, the increase in the purchases of machinery, particularly of tractors, the purchase of stock feed, fertilisers and other agricultural chemicals. It a is convenient time to take stock of this change and risk some judgment on it.

There is no doubt that the handicaps of small farming in the past were attributable mainly to poverty. The fragmented holding was so common because the small farmer simply could not command the funds required to obtain control of a compact farm of adequate size; as small farmers become more prosperous they will no doubt gradually consolidate their holdings into compact units. They will, as they are now beginning to do, cultivate such capital-demanding crops as sugar-cane, cocoa and bananas at a higher rate of investment than before. They will invest in more and better-quality livestock.

Pioneer estates

However encouraging these improvements may be, it must be remembered that they are largely those already pioneered by the estates. The use of fertilisers and insecticides, and the application of power-farming have all been developed by estates and are particularly applicable to the large farm. The small West Indian farmer still concentrates on one main cash crop and his general system of farming is essentially an imitation of the estate; the difference now is that he succeeds in being a better imitator than ever before. But it is doubtful whether mere imitation can guarantee a permanent place in the West Indies for the small farmer. It is logical that if a small farm is essentially a scaled-down model of an estate, small units will gradually become amalgamated in order to reap the full benefits of large-scale operation. There is a risk, therefore, when admiring the very considerable change in status of the small farm in the last 10 years to overlook the fact that his basic system of farming has not really changed, although his technique has improved considerably. It is necessary to consider whether other systems are more suited to the small man and would permanently guarantee his survival as a competitive producer.

In the West Indies it is not always appreciated that the sugar estate has developed into what, by temperate standards, is the most unusual type of farm. A type which combines the intensive use of land with a vast scale of operation; an output per acre of



Poor, steep, inadequate land is characteristic of much small farming in the West Indies

perhaps $300 a year on a centrally managed unit of as much as 20,000 cultivated acres. Such a large unit is possible because an estate is concerned with only one agricultural enterprise. The same characteristic applies on a smaller scale to cacao and arrowroot estates and to cattle ranching. Indeed, monoculture has in the past been the rule in the West Indies and it has not always been realised there that this unusual type of agriculture involves inefficiency in certain respects. The two greatest inefficiencies are the need for a flexible labour supply to cope with the seasonal work and the complete or partial waste of by-products.

The great advantage the peasant has over the large farmers is that he is both proprietor, manager and labourer himself; he can ensure in his own self-interest that every one of his farming operations is more carefully performed than is likely by labourers; his small scale of operation permits constant and minute observation of every unit of his farm and allows prompt action to be taken. It is for these reasons that complicated systems of mixed farming are well suited to the peasant and are confined to small and medium-sized farms. Furthermore, a mixed farm can be designed to make regular labour demands throughout the year and so overcomes the small farmer's great problem of hiring seasonal labour cheaply.

Mixed farming

Although these theoretical considerations are generally well understood, there has been no practical development of mixed farming in the West Indies as yet. The lack of development is perhaps understandable because of the long tradition and high technical efficiency of the estates, and because nobody until recently could show one solitary mixed system that was superior to traditional farms. Many so-called ' mixed ' (though, in fact, merely diversified) demonstration units have been established on Government stations and land settlements, but rarely have adequate accounts been kept and never to the writer's knowledge have the units shown a satisfactory standard of earnings.

This lack of precise knowledge prompted a thorough scientific investigation of the possibilities of full-time mixed farming on a small scale at the Imperial College of Tropical Agriculture in Trinidad. A full report of the investigation has been published,[1] together with a description of the special techniques that were developed to conduct it.[2] It is only necessary here to comment on some of the conclusions. The most important was that there are very definite possibilities for the right system of mixed farming under the conditions investigated; these units had to be confined to one area, the College farm, but it was not particularly favourable and was similar to those of neighbouring peasants. It proved possible to develop farms that gave a regular labour demand throughout the year, that maintained and probably improved fertility. According to the size and the equipment allowed to the farm, the net earnings of the one-man-one-woman unit, after meeting all costs and providing for depreciation of tenant's assets, varied between $1,200 and $2,500 a year. By West Indian standards these earnings have been described as astonishing.

Essential step

In the writer's opinion, these carefully controlled economic experiments by which any theoretical system of farming can be proved or disproved are the first essential step in developing permanent, profitable small farming in the West Indies, and probably elsewhere. The experience at the College during the first three years of their unit farms proved a period of disillusionment and almost every preconceived idea of a profitable system had to be abandoned. Some important general principles developed and there is no need now to repeat many of the mistakes then made, but they do indicate how far theoretical calculations can be very profitable practice. This type of investigation should be carried out in every district that appears to offer possibilities for better small-farming, because it has been found necessary to exploit every local characteristic to the full in order to achieve the requisite level of earnings; a type of farm that is suitable in a certain district in Trinidad will almost certainly be found wanting in another island and probably even in a different district of the same island. Such investigations are at present in progress in St. Vincent and Grenada, using combinations of local crops and exploiting local conditions; although progress to a final profitable result is again proving slow, sound development is being achieved and many practical lessons are being learnt.

These experimental unit farms have created some confusion as to their long-term purpose. It is doubtful whether the lessons obtained from them can be impressed satisfactorily on small

Continued on page 202

PACIFIC SUBSISTENCE CROPS—SAGO

EMILE MASSAL and JACQUES BARRAU

Executive Officer for Health *Subsistence Agriculture Officer*
South Pacific Commission

Sago starch is extracted from the stem of certain plants, particularly of various palm trees, the main ones belonging to the genus Metroxylon. *In the South Pacific, notably in Melanesia, they form the main vegetation of the swampy forests which spread over extensive areas of the lowlands of New Guinea. In these inhospitable regions the limited areas above water makes it impossible for the islanders to grow sufficient subsistence crops for their needs; the bulk of foodstuffs is provided by sago. This article is the fourth in a series on subsistence food plants in the South Pacific and which are published by the South Pacific Commission.*

METROXYLON sago palms grow to a height of between 30 and 50 ft., with a trunk diameter of between 20 and 30 in. Each tree produces only one inflorescence during its life cycle;* this forms around the fifteenth year in an enormous raceme rising straight up from the top of the tree. It is to ensure this late fructification that the large stocks of carbohydrates, used by man for food, accumulate inside the trunk. Each tree dies off after bearing fruit, but the root stock gives out several new shoots. Natural sago groves are thus extremely dense.

Botanical aspects

From the botanical viewpoint, some confusion seems to exist between the various types of *Metroxylon* described to date. Certain botanists, indeed, believe that the distinctions made are perhaps far from completely valid and that many are synonymous. Thus, *Metroxylon Rumphii* Mart., which has a thorny foliar sheath, and *M. Sagu* Rottb., with a smooth sheath, the two species most frequently used for their starch content, have often been considered as two varieties of the same species. Indeed, seeds taken from either one of these trees might produce either smooth palm trees or thorny ones. Among the Marinds in Netherlands New Guinea the memory has been preserved in native tradition of natural groves of thorny sago palms which have gradually become smooth through the empirical selection practised by the natives.

These reservations having been made on the botanical side, here are a few of the species of *Metroxylon* to be found in the South Pacific:

In New Guinea: *Metroxylon Rumphii* Mart., *M. Sagu* Rottb., *M. oxybracteatum* Wav. ex K. Schum.

In the Solomons: *Metroxylon bougainvillense* Becc., *M. salomonense* (Warb.), Becc.

In the New Hebrides: *Metroxylon Warburgii* Becc.

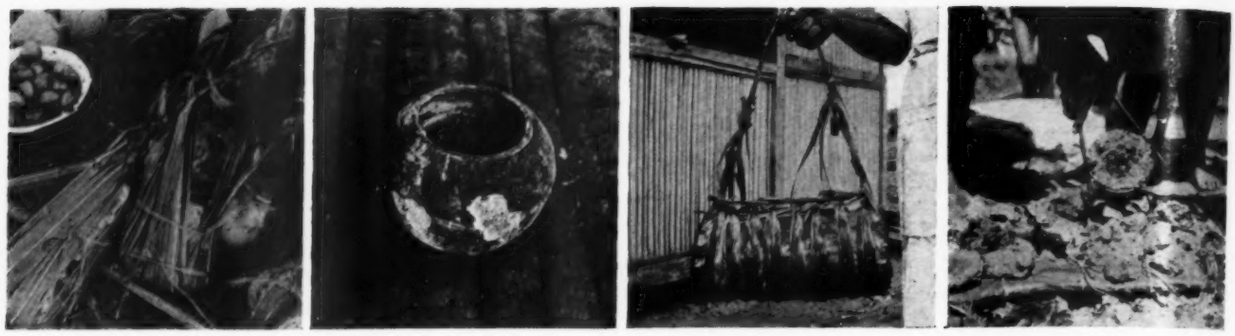
In Fiji: *Metroxylon vitiense* Benth. and Hook.

In Samoa: *Metroxylon upolense* Becc.

In fact, it is only in New Guinea and the neighbouring islands that varieties of *Metroxylon* are actually used for their starch content. In the other territories where these palms exist it is possible that their use as a food was discontinued as far back as the earliest times. Guppy[1] believed that the use of *Metroxylon vitiense* as a subsistence food was lost in this way in Fiji. In the New Hebrides, where people know only through tradition of this use of sago as food, today one comes across varieties of *Metroxylon* grown for their leaves only, which are used in house building. It is possible that at some distant epoch the *Metroxylon* group, whose centre of origin spreads from Malaysia to New Guinea, was transported by men right to the borders of what is at present known as Polynesia.

The islanders use the natural groves and grow sago palms propagated by seedlings and shoots. Eight to 15 years are required before the palm tree

(Left) *A sago grove in the swamps of southern Netherlands New Guinea.* (Second from left) *The pith is removed from the trunk by grating and crushing with a kind of adze, of which the cutting section is a piece of bamboo with sharpened edges. Near Merauke, southern Netherlands New Guinea.* (Second from right) *Washing the sago in a sloping trough, made from a leaf stem of* Metroxylon. *Washing is accompanied by energetic thrashing. As it runs out the liquid filters through a piece of fibrous spathe. Marind, southern Netherlands New Guinea.* (Right) *Another method of washing, with kneading by hand*



(Left) *Bundles of crude sago on the native market at Lae, Australian New Guinea.* (Second from left) *Jar for preserving sago, Lake Sentani.* (Second from right) *Sago briquette, Marind.* (Right) *Sago paste mixed with grated coconut, known as* Sagoe sep *in Malayan, cooked in half a coconut shell in an oven of hot stones*

is worth felling, as it is just before flowering that the reserves of starch stored in the trunk are at their maximum. To prevent flowering exhausting these reserves, the Papuans occasionally remove the bud. Naturally sterile palm trees which accumulate enormous stocks of starch in their trunks are also found; as much as 900 lb. of crude sago has been extracted from such palms. This, however, is exceptional; the average yield is very much lower. Mr. Zwollo, who studied the question recently in Netherlands New Guinea and to whom we are indebted for much of our information on the sago palm, puts it at between 250 and 350 lb. per tree.[2]

In a normal swampy forest grove 25 palm trees can be found per acre per year which are worth felling; this production, amounting to between 6,250 and 8,750 lb. of crude starch with a water content of between 35 and 40%, represents between 7 million and 9,900,000 calories. *Metroxylon* yields, however, vary considerably; certain varieties are particularly poor in starch, and it is possible to find dense groves of *Metroxylon* containing only trees with very low sago production.

In a given area of swampy forest, the local people can pick out a number of varieties of sago palm; thus the Marinds in Netherlands New Guinea distinguish at least eight smooth or more or less thorny varieties with added variations in size, colour, growth and starch yield.

Treatment

After felling, the bark is removed from half of the sago trunk, and the pith is removed by grating and crushing with a kind of adze of which the cutting section is made of rough stone, hard wood or, more often, from a piece of sharpened bamboo. Today, where there is contact with the Europeans, a section of metal piping with sharpened edges is a frequent substitute for the wooden or stone tool.

The crushed pith is washed in an inclined trough, made from a leaf of the sago palm. This process is accompanied by threshing with a lath or by kneading by hand. The liquid containing the starch runs into the trough and filters through a fibrous spathe arranged for this purpose. It is collected in draining pans made from portions of the palm: leaves, leaf stalks etc. The drained sago is then dried partially.

To preserve it, it is wrapped in bundles in palm leaves. These bundles vary in form and are most often cylindrical or conical. If the sago is intended for family consumption only, they are more or less shapeless. Those intended for barter, however, are prepared with particular care. Thus, in New Guinea, the natives hollow out cylindrical holes in the fibrous residue left from the washing process and line them carefully with green *Metroxylon* leaves. They then heap the fresh starch into the hole, using it as a mould; then, wrapping the leaves over the top, they remove the package and bind it fast.

Bartering of sago gave the marsh dwellers in New Guinea the opportunity to procure a number of articles that they lacked: pottery, tools, smoked fish and other foods, notably tubers. This trade entailed real seagoing expeditions such as those made by the natives of the Port Moresby district coming to acquire supplies of sago in the western deltas. Even today intensive canoe traffic continues to ply between the islands in the Geelvinck Bay and the Waropen marshes in Netherlands New Guinea.

Industrialised cultivation and commercialisation of sago would afford a desirable improvement in the living conditions of natives inhabiting the swampy forests where economic possibilities are limited. In fact, although the starch produced by native methods is impure, it might well become an export product. In 1950 the U.S.A. imported approximately 6 million lb. of Malayan or Indonesian sago.

In order to preserve the sago they produce, the natives find it sufficient to keep it damp in a covering of leaves, sprinkling it with water from time to time. Where pottery is known, the fresh sago is merely placed in a large jar and covered with water. In some cases a sago paste is made into briquettes which are dried rapidly on the surface over a fire; these briquettes will keep for about a month. As a general rule, Papuans find that when sago is completely dried it loses its flavour. They consider the starch prepared by European methods as being practically inedible.

Composition

An examination of a number of food composition tables shows that sago consists almost entirely of starch and water. The protein content is very low, in the region of 0.2 g. per 100 g.; fats are completely absent. Mineral salts are only present in very small quantities (ash, 0.35 mg. per 100 g.; calcium, 10 mg.; phosphorus, 12.5 mg.; iron, 1.5 mg.). There are practically no vitamins. It is possible that the fermentation process which develops when sago is preserved in the

wet state increases the vitamin-B content. The water content of sago varies considerably with the samples analysed; it depends on the methods of preservation used by the natives. The calorie value varies in relation to the water content and should be calculated according to the starch content of each sample.

In the South Pacific Commission laboratory in Noumea, Mr. Frank Peters analysed seven samples of sago, or preparations made from sago, from Netherlands New Guinea. Three samples require further analysis for checking; only the results obtained for four samples and, in each case, the value of the constituent elements of the fresh and dried product, per 100 g. of the product, are given in Table 1.

These results call for no particular comment. They indicate clearly the variations in water content of sago preserved according to native methods and coincide with results already known.

Sago can only supply energy needs. In swampy regions of New Guinea, where sago is the staple food, the average daily ration for an adult is about 2 lb. This ration varies, according to Mr. Zwollo, from between $1\frac{1}{2}$ to $3\frac{1}{2}$ lb. of raw sago and represents from 1,700 to 4,000 calories. It is considered that, in order to satisfy its needs, the average family must spend around 10 days per month in sago groves.

Sago is an unbalanced foodstuff and must necessarily be supplemented. Within the ecological environment of the New Guinea swampy forest, animal and vegetable protein, fats, minerals and vitamins are supplied by foraging, in which *Ipomea aquatica* leaves and other greens take the foremost place, and by fishing and hunting. Fresh vegetables are grown on platforms, or in the gardens planted on the limited areas above water. On the edge of the swampy forest or in savannah districts dotted with sago swamps, the diet is supplemented by tubers, roots, greens and pulses from the garden, and by the coconut and hunting.

Sago is eaten in various ways:

Where pottery is known, a sago porridge, accompanied by condiments and greens, fish, shellfish or wild meat, is the most popular form.

Where pottery is not known, a kind of cake is generally made by cooking a sago paste, occasionally mixed with grated coconut, greens, fish or meat, in an oven of hot stones. This paste is cooked either rolled in green leaves, or in half a coconut shell, or else in a section of bamboo.

In districts of Netherlands New Guinea where pottery is used a kind of biscuit, known in Malay as *sagoe lempemg*, which is easily preserved, is made in an earthenware mould which serves as an oven.

TABLE 1
ANALYSES OF SAGO AND SAGO PREPARATIONS, g./100 g.

RAW SAGO	*Water*	*Fats*	*Starch*	*Soluble sugars*	*Ash*	*Fibre*
(*a*) Fresh	26.4	0	71.6	0	0.2	0.4
(*b*) Dried	—	—	97.4	—	0.25	0.55
SAGO 'EGA' Method of preservation in briquette form, wrapped in plaited sago leaves						
	Water	*Fats*	*Starch*	*Soluble sugars*	*Ash*	*Fibre*
Sample No. 1:						
(*a*) Fresh	37.4	0	50.0	0.6	0.4	1.8
(*b*) Dried	—	0	79.9	0.95	0.65	2.9
Sample No. 2:						
(*a*) Fresh	52.4	0	39.7	0.4	0.4	0.6
(*b*) Dried	—	0	83.4	0.85	0.85	1.25
SAGO 'SINOLE' Common preparation made from a mixture of sago and grated coconut, shaped into a flat cake and baked						
	Water	*Fats*	*Starch*	*Soluble sugars*	*Ash*	*Fibre*
(*a*) Fresh	22.9	16.3	58.8	0.5	0.4	1.0
(*b*) Dried	—	21.5	76.2	0.65	0.5	1.3

Co-operative exploitation

Thus, by exploiting natural plantations of sago palms or cultivated palms, the dwellers in the swampy forests of New Guinea obtain this energy food, which is the basis of their diet. Through barter, moreover, sago makes it possible for them to acquire a limited quantity of goods, local or imported, which are becoming daily more necessary for their existence in this ill-favoured area.

It is scarcely possible to increase the food value of sago; supplementing of the diet seems to be reasonably assured by the natural resources. The living conditions of the swampy forest peoples might benefit, at least within certain limits, from industrialisation on the village scale and from marketing of sago. A detailed survey of the possibilities for co-operative exploitation, for instance, of preservation processes and of both the domestic and export markets might clarify the possibilities of supplying the needs essential to the development of the area.

REFERENCES

[1]cf. Guppy, H. B., 'Observations of a Naturalist in the Pacific between 1896 and 1899', London 1906.

[2]Mr. Zwollo has produced, for the use of the Netherlands New Guinea Administration, a remarkable study, unfortunately unpublished, entitled *Sagoe Onderzoek*, devoted to the sago palm and its use.

General

Ridley, *Sago*, 'Agricultural Bulletin of the Malay Peninsula', 1895.

Reyer, *Der Sago*, 'Tropenplanzer', 1901.

Deinum, *Sago*, 'De Landbouw in de indische archipel', 1948, Vol IIa.

Sago in South Pacific Territories

Riley, *Sago Making on the Fly River*, 'Man', Vol. 23, No. 10, 1923.

Lewis, *Use of Sago in New Guinea*, 'Field Museum of Natural History', 1923, Leaflet No. 9.

Sago from the industrial viewpoint

Wyrzburg, *Root Starches (Including Sago) Other than Those of White and Sweet Potato*, 'Economic Botany', 1952, Vol. 6, No. 3.

This article was reprinted, with permission, from SPC Quarterly Bulletin, 1955, 5, 15.

To Authors and Readers

The publishers of WORLD CROPS invite the submission of manuscripts of books to be considered for publication. All manuscripts will be promptly acknowledged and carefully considered by qualified experts. A synopsis with chapter headings should be sent in the first instance, addressed to the Book Production Manager.

The publishers are specialists in industrial, technical and scientific books and have a world-wide selling and distributing organisation.

THERE IN THE JUNGLE MALAYA'S CACAO GROWS . . .

WARNER VANTER

Rubber and tin are the foremost products in Malaya's economy, but if experiments now being conducted at Jerangau are as successful as the first large-scale experiments indicate, then cacao will also play an important role in the Federation's economy. It has been estimated that, given the optimum conditions, one four-acre cacao smallholding will return a gross yield of $M3,000 (£S350).

THE Federation of Malaya may soon add a third commodity to the two, rubber and tin, for which she is already renowned.

In the near future the first smallholders to take up cacao cultivation in the Federation will go into action. A number of four-acre plots (12) have been apportioned under a pilot scheme 'across the road' from the Department of Agriculture's Cacao Experiment Station at Jerangau in the Kuala Brang district of Trengganu. Nearby, several famous concerns in the business world are working along similar lines.

Intensive investigation over a number of years preceded the approval of this pilot scheme by the Federal Government and it can be assumed that the step indicates strong optimism as to the outcome by the experts concerned, because they are watchful against raising false hopes for new industries.

In June 1955 the Report of the Working Party set up to consider the development of a cacao industry in the Federation was made available to the public in view of widespread interest in the possibilities, and it is being studied by the Federal, State and Settlement Governments. Meanwhile, Malaya was represented, along with 18 other countries, at the September 1955 World Cocoa Conference in London, at the conclusion of which the Chairman (Mr. Paul Cadbury) told the Press that nothing discussed at the conference had caused him to change his view that, at the right price, the world could absorb about a million tons of cocoa annually.

Mr. Cadbury told a questioner that he did not think there had been a change in Dr. E. E. Cheeseman's original estimate (in 1948 after an investigation tour in Malaysia) that Malaya might eventually produce about 100,000 tons of cocoa. It is interesting to note that world consumer demand exceeds supply.

It is estimated that 300,000 acres might become available for cacao cultivation in the Federation. Most of the country's best soil is suitable—it should be granitic or volcanic—but on the western side of the peninsula rubber is predominant; the two will not grow together. But on the economically backward east side, especially in the States of Trengganu and Pahang, much of the soil is of the right type and, at last, the jungle is proving useful for providing the much-needed shade. It is 'merely' a question of removing sufficient trees and vegetation for planting space. The oldest and tallest trees, which provide little shade and are also liable to crash and injure valuable cacao at a later date, are removed first.

Future of Malayan cacao

Having a feeling that other countries —especially those where it has been a basic industry for many years—are interested in the future of cacao in Malaya, it seemed a good idea to trace the history of cacao growing in Malaya. My first move was to visit the Government Cacao Experiment Station in Trengganu, the State in which 'commerce' seems most interested at the moment.

Experiment station

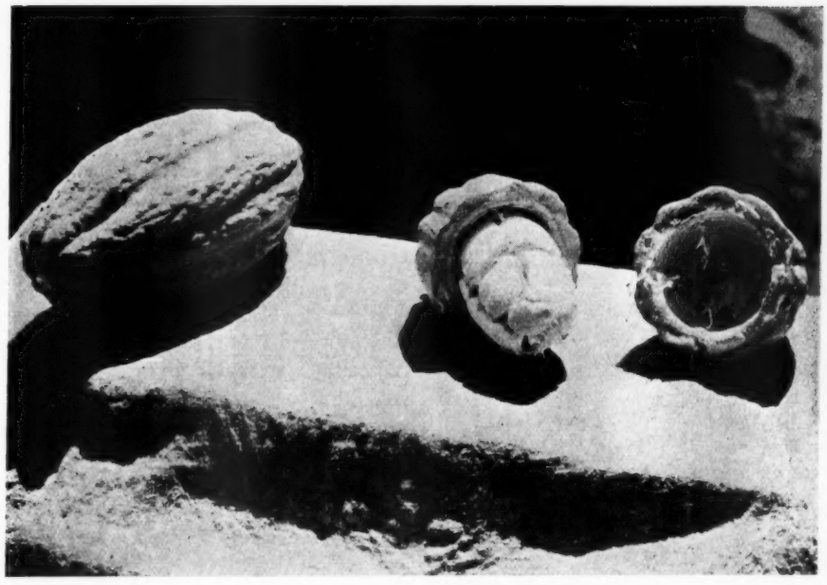
Accompanied by the State Agricultural Officer, a soil chemist and a photographer, we set off for Jerangau, approximately 30 miles south of the capital town of Kuala Trengganu, to what was virtually the end of the road.

The Experiment Station has a 20-ft.-high 'view platform' from which remarkable photos of the cacao can be taken

On arrival at Jerangau Experiment Station, an Assistant Agricultural Officer, Jusoh bin Zain, conducted us through the nurseries and beyond the compound to the edge of the jungle itself.

It has been forecast that eventually Malaya's contribution to the world cacao supply may be the biggest from the Far East—and it was with a sense of privilege that I saw, for the first time, a cluster of almost ripe cacao pods, Malayan grown and, according to the record board nearby, maturing before time (usually a four-year period, these were planted out in 1952).

The many rows of sheltered cacao plants at various stages of growth in the nursery had been tended carefully. After four or five months in the nursery they are transplanted in baskets in jungle plots, 8 ft. × 8 ft., from which the undergrowth has been cleared. The greatest care is taken to keep planting material in the Federation of Malaya free from those diseases which beset cacao in other countries—especially ' swollen shoot ', which has done, and is doing, so much harm in West Africa. Among other precautions taken is the application of sprays, using the latest machines, a performance merely noted in the nursery, but definitely a news picture in the jungle, both the unusual apparatus and the operation.



The Amelonado type of cacao is being fostered in the Federation. Here a Malayan-grown pod is opened; it discloses 40 beans

To quote Mr. O. J. Voelcker (lately Director of Agriculture in the Federation, who is a cacao expert by inclination and experience): ' Cocoa is not an easy crop to grow. Soil and climatic requirements are narrowly defined; pests and diseases are many. The shade-loving tree itself, not dissimilar in size from an apple tree, takes six to seven years to reach commercial bearing, produces maximum yields from 15 to 25 years, with gradual decline thereafter. Replanting is difficult and new plantations confined to jungle lands. . . '. Recalling Mr. Voelcker's dictum aroused additional respect for these agricultural officers of all grades who live lonely lives, virtually in the jungle itself, dedicated to the putting into practice the expert advice from the laboratory researchers at the Federation's Experiment Station at Serdang and at Headquarters in Kuala Lumpur.

The beans have ' taken ' and these young plants, from left to right, are aged 6–12 days, about a week, two weeks, one month, two months and four months. The plant on the extreme right will shortly be moved to a jungle plot

Treatment

There are three types of cacao: Amelonado, Trinitario and Criollo. The first does best in Malaya. And after the Experiment Station's staff had explained details of nursery care and soil preparation, mature Malayan-grown pods were cut open for inspection. Each usually has about 40 beans surrounded by mucilage which, if they are to be used for further cultivation, is removed in sand. For commercial use baskets of beans, with mucilage adhering, up to 100 lb. in weight, are fermented. This operation takes about a week and is carried out to ' bring out ' the flavour. After fermentation the beans are dried naturally and shipped in this condition as soon as possible, since they cannot be stored for long in the tropics.

Yield

A four-acre cacao smallholding is estimated to produce 750 lb. of dried beans per acre, which at, say, $M1 per lb., could give a gross yield of $3,000

per annum. The Federation Working Party Report recommends that State Governments should alienate land to the Rural and Industrial Development Authority in the first instance, which would, with the advice of the Agricultural Department, administer the scheme and transfer the land to the settlers when the cacao is established.

The large nursery at the Experiment Station is tended by young agricultural 'hands', who are fully aware of the need to protect cacao from diseases and pests at all stages during its growth. Spraying is an important precaution

Government aid

Finally, there is great significance in the following introductory comment of the Working Party Report:

'In nearly every other cacao-growing country the industry developed without guidance by Government and the difficulties now being experienced in producing cacao in these countries may perhaps be ascribed to this lack of initial guidance and haphazard development. The mistakes of other countries have given Malaya the opportunity of entering the business of cacao growing at a profitable period and at the same time to profit by their experience so as to avoid the difficulties they have encountered. It is considered desirable, therefore, that the Government should be fully prepared to foster and develop this industry along sound lines'.

Photos: Dept. of Information, Federation of Malaya.

Conservation in Northern Rhodesia

There had been a definite change in the method of Northern Rhodesia Conservation Officers in their approach and application to soil erosion, said Mr. A. N. Beaumont, Acting Chief Conservation Officer in Northern Rhodesia, in a report presented recently to the fourth annual meeting of the Southern African Regional Committee for the Conservation and Utilisation of the Soil, held at Mbabane, Swaziland. In his report on progress made in soil and water conservation in Northern Rhodesia, Mr. Beaumont said that regional planning had been accepted by the Northern Rhodesia Government for a trial period of three years, and had been put into operation in certain areas during the course of this year. Heavy units had already started the mechanical works in these areas. A pilot scheme in the Native area had had most of the mechanical works completed. Mr. Beaumont said that there had been no radical changes of policy concerning conservation in native areas during 1954. The work of the extension staff had been concerned largely with conservation and the expansion of betterment schemes, such as the African Farming Improvement Scheme, the Peasant Farming Scheme and the Control of Shifting Cultivation.

The staff position had improved, he said. The department now had about 60 agricultural officers and supervisors dealing with native agriculture, and 34 stations serving as extension centres for native agriculture located throughout Northern Rhodesia.

OEEC Committee Studies Fertiliser Situation

The Chemical Products Committee of the OEEC met from 16 to 18 January and, amongst other business, considered a report dealing with the fertiliser situation in member countries in 1954–55 and giving estimates for 1955–56. In 1954–55 the production of nitrogenous, phosphate and potash fertilisers increased by 12, 11 and 15% respectively. It is anticipated that in 1955–56 total production in terms of fertilising elements will amount to 2.8 million tons of nitrogen, 3 million tons of phosphoric acid and 2.9 million tons of potash. In 1954–55, exports to non-member countries increased by 6% for nitrogenous fertilisers and 28% for potash fertilisers compared with the previous year.

The report also shows that fertiliser prices generally kept stable in 1954–55 and that no substantial changes are expected in the current year.

Farming Progress in Hungary

State funds totalling £72 million were invested in Hungarian agriculture last year, states the Central Bureau of Statistics. And the pace of farm mechanisation increased.

Nearly 60,000 more families joined co-operative farms or formed new ones, bringing the country's total of such families to 260,000, and increasing by 490,000 acres the 2,403,000 acres already farmed co-operatively.

Crop yields were on the whole above the average of the last five years. The figures were: Bread-corn 2,680,000 tons; barley 790,000 tons; maize 2,920,000 tons; potatoes 2,080,000 tons; and sugar-beet 2,220,000 tons.

Grape and wine production was considerably greater than in earlier years, but quality was weaker, owing to the rainy weather.

Pig stocks grew rapidly and exceeded eight millions. Sheep stocks increased 200,000 over the 1954 figure of 1,821,000.

New British Guiana Programme

The British Guiana Government's development programme for 1956–60 envisages expenditure over the five years' period of £11,875,000 for economic development and £7 million for social development. It provides for the completion of the two major drainage and irrigation schemes now in progress; for the construction of roads and land settlements; and for a continued programme of research into the natural resources of the country.

MEXICAN AGRICULTURAL PROSPERITY

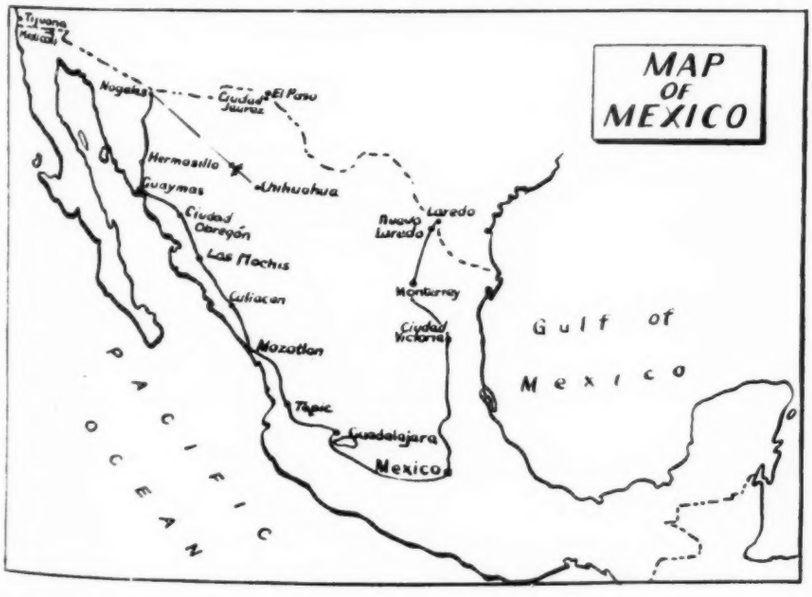
Mr. R. G. Stone, O.B.E., the Commercial Counsellor at Her Majesty's Embassy in Mexico City, has recently made a tour of the West Coast of Mexico, including a visit to Chihuahua, the capital of the central State of Chihuahua. The map reproduced with the article gives some indication of the route taken. The remainder of the article consists of extracts of the Commercial Counsellor's recorded observations of conditions in the territories through which he passed.

I HAVE just completed a second journey by car to the west coast of Mexico and the territory of lower California (North), including a visit (by air from Nogales) to Chihuahua, the capital of the central State of Chihuahua.

My route on this journey took me through the following areas: Guadalajara, the capital of the State of Jalisco; Tepic, the capital of the State of Nayarit; Mazatlán, the well-known fishing port on the west coast of Mexico; Culiacán, the capital of the State of Sinaloa; Los Mochis, the centre of the Rio Fuerte (Miguel Hidalgo) irrigation scheme ; Ciudad Obregón, the region which has grown up with the Yaqui Valley irrigation project and the Oviachic (Alvaro Obregón) power plant; Guaymas, the principal port of north - western Mexico; Hermosillo, the capital of the State of Sonora; Nogales, the border city which leads to the State of Arizona (U.S.A.); Chihuahua, the capital of the central State of Chihuahua; Mexicali, the capital of the State of Lower California (North) and Tijuana and Ensenada, the main Pacific cities of Lower California.

When I made the journey along the west coast of Mexico in the early part of 1953 the Mexican Pacific Highway had not been completed and I had considerable difficulty in travelling between Tepic and Mazatlán, where no bridges had been constructed over the many rivers which flow through this area, and between Culiacan and the town of Mavajoa (near Ciudad Obregón), where the highway was under construction. In 1953, too, the Yaqui Valley irrigation project around Ciudad Obregón had not quite been completed and plans for the Oviachic hydroelectric scheme on the same river had not been finalised; the Rio Fuerto (Miguel Hidalgo) irrigation scheme near Los Mochis was also only in the very early stages.

The progress which has been made all along the route I travelled is most impressive. There is little question that the western states of Mexico are forging ahead economically at a great pace and it is unfortunate that the U.K. has not assisted to any extent in the rapid development which has taken place. Some British companies showed an interest early in 1955 in the Oviachic hydroelectric project, which has been partially financed with funds from the International Bank for Reconstruction and Development, and a British construction company made an offer about 12 months ago to build the Humaya Dam near Culiacan. Our prices were too high for us to obtain the Oviachic contract and the Mexican Federal authorities are still studying what priority should be given to the building of the Humaya Dam.



States of Jalisco and Nayarit

Jalisco and Nayarit are agricultural states.

The more advanced State of the two is Jalisco, where the population exceeds two millions, compared with only 300,000 people in Nayarit. Because the two States form one homogeneous area the larger agricultural machinery manufacturers generally appoint a sub - agent resident in Guadalajara to look after sales in both territories. More than half of the population of the State of Jalisco is engaged directly in farming. The rest work in the milling of sugar and rice, in the production of vegetable oils and in the manufacture of shoes and textiles.

The most important agricultural crops are sugar, maize, beans and peanuts. The harvests of these crops have been excellent in recent years and have produced near-boom conditions among the local farming communities. There is some concern, however, about the

future prospects for sugar and peanuts.

The sugar harvests all over Mexico have been steadily increasing year by year and production has outstripped consumption. The Government have been seeking export markets for the surplus stocks, but are handicapped by international quotas. Since the policy of the present Government is to give all-out support for agriculture, they are most reluctant to ask the farmers to restrict the output of any crop.

The bulk of the peanut crop has always found a ready market in Canada. Last year, however, the principal Mexican producers were offered better prices for their crops in another market, which they accepted and, by so doing, forced the Canadians to look for an alternative supplier. This change in customers has had its repercussions, however, for the Mexicans have so far this year been unable to get back into the Canadian market and their last year's buyer has not put in another appearance. Unless a buyer is soon found it is likely that this season's crop will be turned into oil in local processing plants at a disadvantageous price for the farmers.

Most of the inhabitants of the State of Nayarit are engaged directly with agriculture, producing tobacco, maize, beans, sugar, peanuts and rice. Most of these crops are marketed through Guadalajara. Tobacco is the most important and about 70% of Mexico's total production of this plant comes from here. Because of this large production of tobacco a local cigarette-manufacturing company (in which there is a British interest) has recently set up a factory at Tepic. The establishment of this one factory may give a lead to other concerns interested in the processing of agricultural products to build branch factories here as well. The maize, sugar, beans and peanut crops have also been excellent in Nayarit in recent years and the same boom conditions are to be seen here as in Jalisco.

The State Government of Nayarit, following the policy laid down by the Federal Government, have been encouraging the farmers to increase production. The soil is recognised as being excellent for the growing of rice and the State authorities are seriously considering turning over an additional 40,000 hectares to this cereal during 1956 and 1957.

The good results which have been obtained during the past two or three years from agricultural crops in Jalisco and Nayarit have encouraged the farmers to think of mechanisation and to use better seed, fertilisers, insecticides and weedkillers. Sales of tractors and combine-harvesters in 1955 were an all-time record. Recently the preference has been for diesel tractors, which must have an adjustable wheel base.

The principal American agricultural machinery manufacturers are all intensively active in both States. They have first-class servicing and spare-parts facilities in Guadalajara and keep an adequate travelling staff of salesmen/mechanics who are constantly on the move. It is not surprising, therefore, that the bulk of the agricultural equipment in use here comes from the U.S.A.

Sales of agricultural equipment are not as high as they could be because of an insufficient supply of credit. Although the farmers have been making good profits, they have found many calls on their money. They are still not in a position to pay cash for all the equipment and the fertilisers they need, and their purchases have to be done on a two-year basis with an option to defer part of their indebtedness until the end of the third year.

The Federal agricultural banks, the private banks and the finance houses are all heavily invested in time sales of agricultural equipment, but their resources are still insufficient for the volume of business which is offering.

Agriculture in the States of Jalisco and Nayarit is on the crest of a wave and given good weather even greater progress should be made during the next five to 10 years in spite of the poor outlook for sugar and peanut sales. Prospects for sales of agricultural equipment are very bright and the only problem is the insufficiency of credit facilities.

Several British agricultural machinery manufacturers are represented in Guadalajara and are obtaining orders. The long-term opportunities for other British agricultural machinery companies would seem to be good provided they could establish themselves in such a manner as to be competitive with the firms already firmly entrenched. They would need to arrange for good servicing facilities and to give their agents ample long-term credits for spare parts and for time sales.

The recent harvests have given an impetus to the whole economic life of this region. New construction is to be seen everywhere. Guadalajara itself is growing rapidly. Even the textile industry of the city is feeling the effects of the boom and has been working at full capacity. Optimism abounds and the only restraining factor is that money cannot be made rapidly enough to help develop more and more of the natural resources of the region.

State of Sinaloa

The State of Sinaloa is, like the neighbouring States of Nayarit and Jalisco, an agricultural region. The population is now reaching the three-quarters of a million mark, but many more people will be needed in the next few years if full advantage is to be taken of the wonderful farm lands which are being obtained from the irrigation works around Culiacan and Los Mochis. When the President launched his ' March to the Sea ' programme in 1953 he talked of the need for taking people away from the overcrowded plateau of which Mexico City is the centre and of transferring them to the undeveloped areas of the littoral. There has not been any noticeable movement of people away from the central plateau in the past three years and the complete development of the Culiacan and Los Mochis zones must await these new immigrants.

Almost every known industrial and market-garden crop can be produced in the State of Sinaloa. The main crops at the moment are sugar, maize, chick-peas, tomatoes, chili, melons, alfalfa, rice, peanuts and cotton. Sinaloa also has a few industries connected with agriculture. Sugar refining, the production of vegetable oils and cotton ginning have made headway in recent years, but there is still room for improvement.

Culiacan is not only the capital, but also the largest city of the State of Sinaloa. Most of its present prosperity is due to booming farm conditions. Several small irrigation works have been completed during recent years which have opened up excellent farming lands. The full benefit of these new

lands will not be obtained until a dam has been constructed on the Rio Humaya and the waters of this river have been put to full use along with the waters of the Rio Sinaloa and the Rio Culiacan. President Ruiz Cortines promised the State of Sinaloa during his election campaign in 1952 that the Humaya Dam would be constructed during his term of office; that is, before the end of 1958. When the decision is taken by the Federal authorities to go ahead with this project, competition for the contract will been keen. Bidders for the job will have to offer realistic credit terms to be considered.

Sugar is the traditional crop of this region, especially in the Los Mochis area, and the local farmers continue to place more and more of their lands under sugar in spite of the difficulties which have increased year by year in the disposal of the harvests. The municipal authorities of Los Mochis are doing all they can to obtain new outlets for this sugar.

Another problem crop is chick-peas, for which the only sizeable export market is Spain; all of the other crops are finding immediate buyers. The quality of these crops is outstanding and it is probably quite safe to predict that no problems will arise with regard to their disposal.

The pride of the State is, of course, the ' Miguel Hidalgo ' Dam on the Rio Fuerte. This is a magnificent work by any standards. The final cost of the irrigation scheme will be in the neighbourhood of 200 million pesos.* The main canals are in operation and very little remains to be completed. The waters from the dam will be irrigating approximately 600,000 acres of land before the end of 1956.

American farm machinery manufacturers are firmly established in Culiacan and Los Mochis. In several instances they have excellent showrooms and first - class spare - parts departments. Their sales have been good, but as the population grows and the new farm lands are brought into production they expect to reap a rich reward for their pioneering activities. Not only have American farm machinery manufacturers entered this region in strength, but one large American department store company recently opened a fine store in Culiacan. The optimism of the people of Sinaloa is very high. They are sure that they will, within the very near future, be playing a most important part in the economic life of their country.

* £5,714,285 (approx.)

Wherever feasible, Mexico is introducing mechanised farming. This ranges from co-operatively owned equipment by co-operative farmers to vast agricultural ranches

State of Sonora

The enthusiasm of the population of the adjoining State of Sonora is no less than that of the people of Sinaloa. Although it is rich in minerals, most of the people are in some way or another connected with agriculture. Since the opening of the ' Alvaro Obregón ' Dam on the Yaqui River in 1953 Sonora has been breaking all harvest records. The lands watered by this dam are the equal of any in the world and will produce almost any crop. It is partly due to the record yields which have been obtained from this section of the country that Mexico has not had to enter the world's markets this year for wheat, maize and beans to supplement her own supplies.

Cotton, wheat, rice, alfalfa, flax and market-garden produce are the main crops that are being grown. Yields of these crops have surpassed all expectations and because the quality has been so high their marketing has presented no problem.

Ciudad Obregón and Guaymas

Transport by sea has been improved by the rehabilitation work which is being carried out in the port of Guaymas under the President's ' March to the Sea ' programme. This work is going ahead steadily and ships have been loading cotton for Japan without any trouble.

More buildings are still required for the storage of cotton and wheat. The Federal authorities have been giving this matter a great deal of attention and they have received considerable assistance from American cotton-purchasing concerns who, seeing the opportunities open to them through the enormous increase in production, have established cotton gins and storage installations in and around Ciudad Obregón. This ancient town, which has grown into a metropolis almost overnight, is the centre of the Yaqui River irrigation project. The entire region serviced by the dam is now so bustling with economic activity that the people are convinced that there is nothing which can prevent Ciudad Obregón from becoming the Chicago of Mexico. It is outstripping Hermosillo, the capital of Sonora, as the distribution centre of the State. Most of the American farm machinery manufacturers are represented either by their own branch offices or by Mexican agents in Ciudad Obregón. They have good stocks of machines and spare parts and keep a servicing staff travelling round the countryside. They have been making remunerative sales, but have not been able to do all the business which has been offering because of the inadequacy of finance facilities, as in Guadalajara and Culiacan.

Hermosillo and Nogales

Although Hermosillo will probably in time have to give pride of place to Ciudad Obregón as the principal distribution centre of the State, it has also been enjoying great prosperity and has not been left behind in the boom. The land immediately adjoining the city has for many years been irrigated with water obtained from deep well pumps. The supply has been augmented, in recent years, with water from a small irrigation scheme, but the possibilities here of irrigating more land are limited. Between Hermosillo and Nogales, the north-western border town, the land is more suitable for cattle grazing, which has been the principal activity of the inhabitants for many decades.

Chihuahua

This central State is the largest of the Republic. It is a mining and agricultural area and, like the other parts of the country, it is glowing with prosperity.

The main reason for the recent prosperity of Chihuahua is the Central Government's encouragement of agriculture. The State produces cotton, cereals and fruit. It also has a thriving cattle industry. The use of fertilisers and good-quality seed have increased yields and brought rich rewards. The reopening of the United States' border to imports of Mexican cattle has given new life to this economic activity. A good road has been built to Casas Grandes, a centre for lumber and cattle, which has opened up this region, and a joint-venture Italian/Mexican company, Celulosa de Chihuahua S.A., has recently started the production of wood pulp for newsprint or rayon at a previously deserted spot some 60 miles west of the city of Chihuahua.

Lower California (North)

The State of Lower California (North) has not been left out of the wave of prosperity which has been flowing over Mexico during the past 15 months. Mexicali, the capital, shows progress similar to that to be seen in the west coast states and in Chihuahua. This is another agricultural region which has been going ahead because of wise irrigation schemes and intelligent use of mechanisation and fertilisers. There has been no difficulty in disposing of all the crops which have been harvested. Cotton, market-garden produce and olives have all been giving good yields and good profits, and the wine industry, in spite of increased production, is still not able to meet local demands.

The economy of this State is tightly linked with the U.S.A. and any serious drop in economic activity in California would have its repercussions in Lower California. As in other parts of Mexico, there is in Mexicali some concern about the future prospects for cotton. This area is heavily committed with this fibre and a severe drop in price would be most harmful.

Conclusion

Three years ago I wrote that there was probably no country in Latin America which had made so much progress economically in the last few years as Mexico. This remark is probably still correct. Mexico's prosperity has not been obtained with one product. Her economy has been built up on a variety of activities and on a variety of products. A great deal of planning and foresight, by both Federal and State authorities, has been necessary to achieve what has been done. That they have been fortunate in world conditions may be true, but this fact does not in any way detract from what they themselves have done.

Sales opportunities abound. They are not in consumer but in capital goods. The difficulties are obvious. The tight hold of United States industry over the whole Mexican economy because of its proximity is tremendous and terrifying to the newcomer. Yet others have shown that it can to a certain extent be broken. If British manufacturers want a share of the market they will have to take it seriously and be realistic in their approach. Mexico needs capital goods of every description to exploit her innumerable natural resources. She is making money rapidly, but still in insufficient quantities. A serious sales effort must be backed up with services and credits. Without them the effort will fail.

This note was published with special permission from the Commercial Relations and Exports Department, Board of Trade, London.

New Fluorescent Fitting

A new 80-W., 5-ft., single-lamp, fluorescent fitting for the industrial market has been introduced by Philips Electrical Ltd. (Century House, Shaftesbury Ave., London, W.C.2). It is known as the ' Boston ' (A6630).

The new fitting is finished in white stove-enamel, and may be ceiling mounted, or suspended by rod or chain. There is provision for the attachment of a ' Perspex ' Diffuser if required.

Colorado River Scheme

The Colorado River rises in the snowfields of the Rocky Mountains and cuts a 1,400-mile south-westerly path across seven states as it carries millions of tons of water a day to the Gulf of lower California. Yet the upper part of the river's basin, a potentially rich area of 110,000 square miles, is largely a semi-arid region of mountain and desert. As has been the case with other rivers in the United States, the giant Colorado River drains rather than irrigates much of the land through which it courses. Using its water to support large-scale agricultural and industrial development in its upper basin has long been a matter of public concern.

The first step has been taken to make this wasteland bloom, just as was done in previous years in other parts of the West. This month, Congress approved a co-ordinated water conservation and development plan that will transform into fertile fields some 132,000 acres now idle, and will supply additional water to another 234,000 acres now under cultivation but not producing all they could. In addition, it will harness the untamed waters of the Colorado and its tributaries to generate about 900,000 kW. of electricity.

One important by-product of the development will be a significant improvement in the living standards of the Navajo American Indians. Many of the acres to be brought under cultivation are on Indian lands, where the Navajos have been hard put to earn a living from the arid soil.

The upper Colorado plan is the biggest water-development project approved by Congress under President Eisenhower's reclamation policy. It fits his definition of a plan eligible for Federal financing—i.e. too large and too costly for local development.

AGRICULTURAL DEVELOPMENTS IN FIJI

W. J. A. PAYNE and R. R. MASON
(*Fiji Department of Agriculture*)

There are over 300 islands, 97 of them inhabited, in the Fiji archipelago. The group occupies a central position in the South-West Pacific between 15° and 22° latitude south of the Equator and 177° west to 175° east of longitude. The total land area of the group is 7,022 sq. miles, with two islands, Viti Levu (4,011 sq. miles) and Vanua Levu (2,137 sq. miles) occupying 88% of the total land area. There are two other medium-sized islands, Teveuni (168 sq. miles) and Kadavu (158 sq. miles), but the majority of the islands are small.

THE climate of Fiji is tropical, the mean annual temperature in the coastal areas being 77–78° F. with absolute maximum and minimum temperatures of 96° F. and 48° F. respectively. Locally three definite climatic zones are defined; wet, dry and intermediate. This is because of pronounced differences in the total amount and distribution of rainfall between the large and the small islands, and between the windward and leeward coasts of the large islands. The prevailing winds are South-east Trades and the mean annual rainfall on the windward coast of the large islands is 120–140 in., but it is only 60–70 in. on the leeward coast. The area of high rainfall is known as the wet zone and the characteristic vegetation is tropical rain forest; the low rainfall area is known as the dry zone and is characterised by open grasslands with trees along the valleys and creek banks. The area between the wet and dry zones receives 70–90 in. of rain and is known as the intermediate zone, the characteristic vegetation being high reed interspersed with small areas of forest. The climate of most of the small islands is similar to that of the intermediate zone in the large islands. The archipelago is situated in the hurricane belt and destructive hurricanes sweep across the group at irregular intervals.

Population

The population is very mixed, there being three main racial groups—Fijians, Europeans and Indians—who comprise the largest single group. It was estimated to be 321,000 in 1953 and is rising rapidly, as the mean birth and death rates of all racial groups were 40 and 9 per thousand respectively in 1953. Land sales by the Fijians have been prohibited since cession and Fijians own the major part of the land under a communal system. The control of this land is vested in the Native Land Trust Board, which is charged with the duty of administering the land for the benefit of the native owners. The part of Fijian land that was alienated before cession includes much of the fertile and easily worked land in the country and is privately owned. All other land utilised by non-natives is leased from the Native Land Trust Board.

Agricultural settlement on the large islands is almost entirely confined to the coastal plains and river valleys, the

TABLE 1
LAND UTILISATION IN FIJI
(Based on 1954 statistics)

Crop	Acreage	
Cereals:		
Maize	200	
Rice	34,966	
Others	75	
		25,241
Pulses		1,880
Roots:		
Dalo (taro)	12,000	
Tapioca (cassava)	16,050	
Yams	2,780	
Others (potato, sweet potato, arrowroot)	1,065	
		31,895
Oil seeds, spices, fibres		570
Beverages (yaqona, coffee)		4,050
Vegetables		820
Fruit:		
Bananas	5,000	
Citrus	250	
Pineapples	750	
		6,000
Sugar-cane		92,960
Coconuts		167,540
Total cultivated crops		340,956
Rough grazings		125,000
Permanent pasture		35,500
Fodder crops		600
Total grass and fodder		161,100
Total area of land used for agricultural purposes		502,056
Total area of land		4,494,080
Total area of land apparently unused or unusable		3,992,024

Typical intermediate-zone country showing the hill grazings and alluvial flats, and bush in the gullies. The alluvial flats in the centre are planted with sugar-cane

interior being rugged and mountainous. The coastal belt is generally narrow and comprises alluvial plains edged with mangrove swamps and backed by low hills. The large islands are well watered, rivers and streams being numerous.

Table 1 shows how the land is utilised in Fiji today. Coconut plantations, sugar-cane farms and grazing lands occupy 84% of utilised land. With the exception of a relatively small banana area the remainder is used for locally consumed crops, the most important being rice, root crops and ' yaqona ' (a local beverage). Table 2 gives details of the number of stock in Fiji at the last census in 1950. It is probable that the area of rough grazings has been under-estimated in Table 1, as quite large areas are illegally grazed.

TABLE 2
LIVESTOCK IN FIJI (1950 CENSUS)

Cattle ..	80,845
Horses ..	16,164
Pigs ..	8,615
Goats ..	23,787

Agriculture is the major industry and the economy depends upon agricultural exports, mainly sugar and copra or coconut oil. Unfortunately, the country has been unable to maintain, let alone increase, the volume of agricultural exports in proportion to the rapid rise in the population, and at the same time the volume and value of food imports has grown (Table 3). It is considered essential to increase the total volume of agricultural exports and, if possible, to diversify them so that a slump in one commodity does not jeopardise the economy, and at the same time increase the production of food for local consumption. This would reduce the volume of food imports so that available foreign exchange could be used to purchase essential industrial goods rather than food.

Increasing productivity

Many factors are concerned in a drive to increase productivity in agriculture in any country, including social, political and economic factors that are outside the jurisdiction of a Department of Agriculture. The Department's function is to ensure that there are no technical problems impeding productivity. The work that is being done in developing and improving agricultural methods and the general rural economy is briefly reviewed.

A soil survey has been initiated and the survey of the island of Viti Levu, representing more than half the land area of the colony, has been completed. The first results from this survey can be used as a rough guide to the problems of the whole colony. Details of the classification of soils are shown in Table 4. Almost all the fertile alluvial, terrace and rolling land soils and some of the hill soils are already utilised. The only large areas of fertile soil that are unexploited are the marine marshes found all around the coast and the hill soils of the dry and intermediate zones. Almost one-half of the island is steep hill country, covered by tropical rain forest in the wet zone and grassland or reed in the dry and intermediate zones. Some of the steep hill country in the dry and intermediate zones should be afforested, but some, providing that grazing is controlled, could certainly be used for stock raising. Productivity can only be raised on the fertile alluvial terrace and rolling land soils by improving agricultural techniques, but it could be increased by enclosure on the fertile intermediate and dry-zone hill

TABLE 3
IMPORTED FOODS THAT COULD BE PRODUCED IN FIJI

Food	*Quantity, tons* 1949	1954	*Value, £s* 1949	1954
Animal products:				
Milk, butter, ghee etc. ..	632	840	129,730	258,056
Meat, fresh and canned ..	881	1,121	130,025	292,688
Fish: fresh, canned, dried, salted	862	786	157,147	157,357
Eggs and poultry meat ..	—	—	—	15,366
Total animal products ..	2,375	2,747	416,902	723,467
Plant products:				
Pulses	669	1,123	40,013	73,088
Rice	540	633	23,884	52,446
Spices	145	167	15,472	31,938
Coffee	25	18	7,864	15,081
Edible oils and fats*	123	395	19,062	84,887
Total plant product	1,502	2,336	105,295	257,440
Total animal and plant products	—	—	522,197	980,907
Total imports (value only) ..	—	—	6,990,977	11,642,801
Imported foods that could be produced in Fiji as a percentage of total imports	—	—	7.5%	8.4%

* Mixed animal and plant products.

soils and by reclamation on the marine marshes.

Investigational work

With the exception of investigations concerned with integrating sugar-cane into arable and alternate husbandry rotations, the Department of Agriculture is not responsible for investigational work on sugar-cane culture. Technical officers of the Colonial Sugar Refining Co. Ltd. carry out this work and are experimenting with new varieties and the control of cane disease. It is hoped that two new varieties known as *Pindar* and *Ragnar*, bred by the staff of the company in Queensland, will prove suitable for Fiji.

It is proposed to set up a coconut investigational station on Vanua Levu, but to date little work has been done on the husbandry of coconuts. The most urgent research problem is to find a method of controlling the rhinoceros beetle (*Oryctes rhinoceros* L.). This was first discovered in Viti Levu in 1953 and, despite a vigorous control campaign, directed by the Coconut Pest and Diseases Board, is slowly spreading in eastern Viti Levu. Fortunately, the coconut industry is concentrated on other islands and thorough control measures are being taken to prevent its spread to the coconut areas outside Viti Levu. On the initiative of Fiji, the South Pacific Commission is investigating methods of control of this pest and is employing entomologists in Western Samoa and India to study the beetle in areas where it has been established for a long period in the hope that some method of control, possibly biological, may be discovered.

Husbandry investigational work on bananas, local food crops, particularly rice and roots, pasture and fodder crops and livestock, is concentrated at two stations, Koronivia and Sigatoka. Investigational work at Koronivia is mainly concerned with crop problems, whereas the work at Sigatoka is mainly concentrated on livestock problems.

Rice

Rice is the staple food of the Indian population and, although the national crop is increasing slightly each year, it falls short of demand by some 600–800 tons, the gap being filled by imports from Australia. The price varies slightly, but is usually above one shilling a pound, hence improvement in the yield and reduction in the cost of growing it would play a considerable part in reducing the cost of living of the urban Indian population. The chances of improvement are good, since most of the varieties grown were introduced haphazardly from India by indentured labour during the last 50 years and are not necessarily suitable. The Department has already introduced improved varieties from British Guiana and introductions are being made from other countries. A search is being made for short, strong-strawed varieties, as lodging is the most serious problem. A Malayan variety under trial at present is very promising. Some Indian × Japanese hybrid varieties produced under the FAO scheme have also been obtained from Malaya. Fertiliser responses have been found to be fairly constant when nitrogen is applied to dry land crops, but increased yields have rarely been obtained on wet land. Phosphate appears to give more response in the dry than in the wet zone, but sufficient experiments have not yet been completed.

Indian farmers cutting sugar-cane. Technical officers of the Colonial Sugar Refining Co. Ltd. are experimenting with new varieties

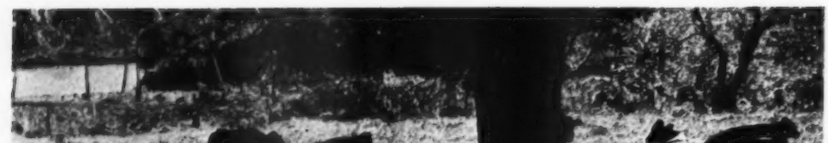
TABLE 4
CLASSIFICATION OF SOILS IN VITI LEVU

Category	*Area, acres*
Alluvial and terrace soils:	
Fertile	152 320
Infertile	22,400
Rolling land soils:	
Fertile:	
Dry and intermediate zone	142,080
Wet zone	19,200
Infertile:	
Dry and intermediate zone	53,120
Wet zone	71,690
Hill land soils:	
Fertile:	
Dry and intermediate zone	233,600
Wet zone	5,760
Infertile:	
Dry and intermediate zone	92,800
Wet zone	486,400
Steep lands	1,210,880
Marine marshes	73,600
Unclassified	3,200
Total	2,567,040

The general standard of cultivation of rice is low and investigations have shown the improvements that are possible by levelling and bunding land for water retention and by treating dry land rice as a rotation crop. The latter can be fully mechanised apart from harvesting, the remaining requirements being a suitable variety and a small cheap machine capable of working in small fields. Progress has also been made in the use of mechanical power for the preparation of wet lands, but the problems of wet land cultivation are very complex.

Bananas

Experiments are being carried out to investigate comparative methods of cultivation of bananas. It is already clear that yields are greatly depressed by a grass cover between the plants



European-type dairy cattle (Friesians) resting in the shade away from the morning sun. The pasture grass is Nadi blue grass (Dicanthium caricosum)

in comparison to clean cultivation. Regular application of a complete fertiliser mixture from planting is giving an average increase of over 100% in yield of fruit. Together with regular pruning, dusting to control scab moth and spraying with Bordeaux mixture for the control of leaf-spot (*Cercospora musae*), these methods indicate how the quality and quantity of fruit can be considerably increased.

Root crops

Most root crops are grown by Fijians in small food gardens as subsistence crops, and changes in their methods are not easily introduced. Variety collections are being established and variety trials are being undertaken on cassava and sweet potatoes, which can be grown as mechanised crops. Fertiliser trials on these crops show that cassava, but not sweet potatoes, consistently responds to the application of nitrogen.

Pasture

Pasture investigation work is one of the most important sections of the Department's research work, as approximately one-third of the country is natural grassland, and as the soil survey has shown, the largest area of fertile land left unexploited is on the hills of the dry and intermediate zones and these are mainly suitable for grazing. It is being conducted in three phases: the introduction of promising grass and legume species from overseas, the evaluation of the agronomical and nutritional value of promising species, and finally their trial under practical grazing conditions.

At present it is considered that the most valuable grasses for the wet zone are carpet grass (*Axonopus compressus*), Batiki blue grass (*Ischaemum aristatum*) and para grass (*Brachiaria mutica*).

Each has its ecological place, carpet grass on the tops of the low eroded hills, Batiki blue grass on the sides of the hills where weed control is difficult and para grass on the moist flats. The most valuable grasses for the dry and intermediate zones are Nadi blue grass (*Dichanthium caricosum*) on the poorer and guinea grass (*Panicum maximum*) on the better soils. The dry and intermediate zones do not lack legumes, as there are as many as five suitable species found on the rough hill grazings, but none of them provide a large bulk.

Centro (*Centrosema pubescens*) is is quite promising and the recently introduced creeping indigo (*Indigofera endacaphylla*) had every appearance of being very promising, but is now thought to be toxic to stock. It is realised that the management of grassland is of equal, if not greater, importance than obtaining the most suitable species, and the problems of management and fertilising pastures are being studied at both stations.

Livestock

Livestock investigational work is important, not only because of the importance of livestock in the country's economy, but also because the largest potential expansion of agricultural productivity is in livestock products, the largest area of unexploited land of good fertility is best suited to stock farming, and home production of more animal products would both improve local nutritional standards and make for considerable savings in the import bill (Table 3).

The majority of the country's cattle are of mongrel European origin, though a number of zebu cattle have been imported in the past, and there are a considerable number of crossbreds. An experiment at Sigatoka, using identical twins, in which one twin of each set was reared in New Zealand and one in Fiji, has shown that European-type stock are not fully acclimatised to Fiji and that as a consequence growth is slow, production low and mortality high. Methods of importing strains of zebu milking cows, such as the Sahiwal and the Red Sindhi, are under examination and at the same time selection for heat resistance in European-type cattle and methods of ameliorating climatic stress are under investigation.

Individuals of the pure-bred zebu cattle (American Brahman and other Ongole–Krishna Valley types) originally imported into the colony have been brought together in one herd at Sigatoka and are being bred as a beef herd. Selection will be made for beef conformation. Santa Gertrudis bulls (a stabilised zebu–Shorthorn cross) have been imported from Australia and are being used to 'grade up' European-type stock to the Santa Gertrudis. Crossbreeding studies, using zebu bulls and European-type milking cows, have shown that the crossbred is very superior for beef production.

Goats in the colony are of very mixed ancestry and are small. Average carcass weight at the slaughterhouse is only 18 lb. Crossbreeding studies, using Angora and Saanen sires, have commenced with the aim of producing a larger animal.

Pigs thrive well in Fiji when properly managed and fed, but there are two major problems confronting the pig

producer. The high incidence of the kidney worm (*Stephanurus dentatus*) makes it impossible to run pigs on pasture except when they are strictly rotated and, secondly, animal protein feeds are scarce. The use of antibiotics with plant protein to replace animal protein has been investigated, as has the production of pigs in conjunction with fish farming. The fish *Tilapia mossambica* was imported from Malaya during 1954 for use in these investigations. Effluent from the piggery is run into a pond, thus increasing the growth of algae and phytoplankton. The fish live on the microscopic life in the pond and can then be fed back to the pigs as part of the animal protein ration. An aquatic plant known as *Ipomoea reptans* is grown on the surface of the pond and has been found to be a first-class fodder for pigs and cattle.

The poultry industry is handicapped by lack of a continuous local supply of feeds. Day-old chicks were all imported from Australia and New Zealand in the past, but an electric incubator has been set up at Koronivia and during 1954 13,000 chicks were hatched and 9,000 were distributed locally.

Extension work

The extension division provides a large number of essential services for the farming community and the general public and, in addition, carries out certain special duties. Some of these are described below.

With the co-operation of the South Pacific Commission, a Plant Introduction and Quarantine Station has been established and many valuable introductions have been made through this station during the last two or three years, including various varieties of cocoa, pepper, grasses and legumes.

As was stated above, it would appear to be desirable to diversify the colony's exports and an attempt is being made to establish a cocoa industry. A survey of approximately 5,000 cocoa trees scattered throughout the colony is almost completed and seed from some of the best trees is being planted up. Good types of cocoa have also been imported and propagators have been set up so that clonal planting material can be distributed. Six seedling nurseries have also been established. Approximately 130 acres of cocoa were planted during 1954. Pepper and coffee also offer possibilities as export crops.

Unloading bananas at a riverside packing station. The bananas are ferried down the river on bamboo rafts and are packed for export to New Zealand

The reclamation of the marine marshes would add a considerable area to the fertile alluvial soils of the colony. Mr. McNee, Director of Drainage and Irrigation in the Federation of Malaya, toured the colony in 1954 and advised the Government on the practicability of initiating a large-scale drainage programme.

Soil conservation, originally demonstrated as a pilot project, has made many farmers in the dry zone conservation conscious and real progress has been made. A Land Conservation Board was set up during 1954.

Mechanisation

Mechanisation has proceeded very rapidly since the war and the density of tractors is now approximately one per 500 acres of arable land. This is resulting in better and more timely cultivation, but since no crop is grown by completely mechanised methods there is little reduction in the total demand for labour. Before the war the only type of tractor in use was the medium to heavy American crawler and wheeled tractors were scorned, but shortage of dollars and the availability of versatile small to medium tractors on rubber tyres have changed the position. There are at present about 70 crawlers, 592 wheeled and 12 horticultural tractors in the colony. The majority are used on cane farms. Disk ploughs and disk harrows are the most commonly used implements. Many farmers have opened up roads into formerly inaccessible country, using mounted blade-terracers and this has allowed greater use of trailers. Farmers are now becoming conscious of the value of spraying for weed control and knapsack sprayers are often used.

One of the main limitations in mechanising agriculture is in the inefficiency of the operator in maintenance and the use of machinery. Unfortunately, there are no tractor schools, although some of the local agents give brief instructions. General agricultural education is being given on the one hand by schools with an agricultural bias and on the other by two special agricultural schools. Most boarding schools are sited on farms and the Young Farmers' Club organisation is popular in the primary schools. The two special agricultural schools are run by the Colonial Sugar Refining Co. and the Methodist Mission respectively, and both emphasise practical training in order to fit the boys to leave at about 18 for practical farming on their own. The Department has recently set up a Farm Institute to provide a more advanced two-year course, designed primarily for the training of its own junior staff.

Photos : R. R. Wright

Japanese Experience in Protective Planting

Erosion Control in Mountainous Areas

MASATAKA OHMASA

(*Director, Government Forest Experimental Station, Meguro, Tokyo*)

Some of the methods employed in Japan to re-establish a vegetative cover on hill slopes, which have earlier been denuded by man or unusually heavy rains, are described in this article. Many types of trees are useful for this purpose and the author lists many varieties that are commonly used in Japan.

A CONSTANT struggle is waged in Japan against erosion and landslides on hill slopes laid waste by man or devastated by exceptionally heavy rains. The general aim is to re-establish a vegetative cover as rapidly as possible and if this can include useful tree species, so much the better. There is no exact standard method laid down for carrying out operations because the topography, soil and local climate with which the forester has to contend vary from place to place. But the following practices are those most commonly employed in Japan.*

Preparation of the Site

The site to be reclothed with vegetation is prepared in two stages. The surface of the eroded land is first evened off; then it is stabilised. But in the case of a hillside with a slope of 25° or less and with a fairly regular surface special preparation of the site is regarded as unnecessary. However, wherever there is a tendency for the debris accumulated on the lower slopes of a hill to become sodden from rain or melting snow and threaten a landslide, preventive measures are taken as soon as the accumulation has reached a depth of 3 m. or more, stone or wicker revetments or cylinders of wire being embedded in the ground (hence these are called ' buried works ').

Restoring the slope of a hill which has been cut up by erosion, torrents or by a landslide is a necessary preliminary to the turfing or terracing operations which will follow. Material obtained from levelling the surface is used to fill the depressions and fissures cut in the hillside, the work starting at the top of the hill and proceeding down to the foot. Care is taken not to interfere with any patches still carrying natural vegetation.

Site preparation and levelling are carried out by manual labour, using picks and shovels. Sometimes use is made of explosives, and mechanisation of the operations, employing rock-drills and other equipment, is now being studied.

Once the surface of the hillside has been satisfactorily levelled, it is terraced by much the same methods as are used in other countries. The hillsides that require treatment in Japan are, however, usually fairly steep, so that the terracing takes on the appearance of a series of ascending steps. The terraces are made stable either by turfing, by simple terrace works, or by masonry or wicker revetments (Fig. 1).

Turfing

This method is usually employed where there is a slope of 30° and the ground is fairly hard. The horizontal steps vary from 1.5 to 3 m. in height and 0.6 to 1 m. wide, according to the slope of the hillside.

Turfs are placed at the base, on the face and on the top of the outer edge of the step, and made compact with earth taken from the inner edge, as shown in Fig. 2. To prevent the turfs on the face of the step from slipping, they are usually braced by shoots of *Shinoarundinaria* sp. and stakes of *Salix* spp., driven some 15 cm. or more into the ground as supports.

The turfs are, as a rule, cut from natural grass cover in a forest area and are 20 to 27 cm. long, 30 to 40 cm. wide and 10 cm. thick. They survive quite well provided the ground into which they are transplanted has a fair moisture content. Results are poor in places where there is much seepage or considerable dampness.

Simple terrace works

These are only effective where there is a reasonable depth of soil and the slope is moderately gentle. Steps are made in the hillside about 0.5 m. wide at intervals of about 1 m. The top of the steps is hoed to a depth of some 15 cm. to make a tilth. Along the outer edge of the step *Torreya nucifera* or *Lespedeza bicolor* is planted in parallel strips and behind these tree seedlings are planted. (See Fig. 3.)

Various materials are used to protect the front face of the step: turf, straw bundles, fascines, stone, logs or poplar stakes. Frequently some parts of a hillside, otherwise requiring turfing, can be treated by simple terracing.

Wicker work and masonry

This is employed on slopes that are too steep for turfing to hold. Wicker work prevents the soil from slipping and holds the slope firm. It is usually about 20 cm. high, although in rare cases it can be as much as 50 cm. It is held by stakes that are driven into the ground at an appropriate angle.

Masonry means dry-built stone walls constructed against the hillside, and is used where the ground is very damp or where ' evening-off ' is difficult to perform owing to rough hard ground unsuitable for terracing. Masonry revetments are also constructed to prevent earth filling or spoil from sliding down the slope. Masonry is apt to be expensive, however, unless there is a

* An extract from a contribution to a forthcoming FAO Forestry Development paper dealing with ' Tree Planting Practices for Temperate Asia '.

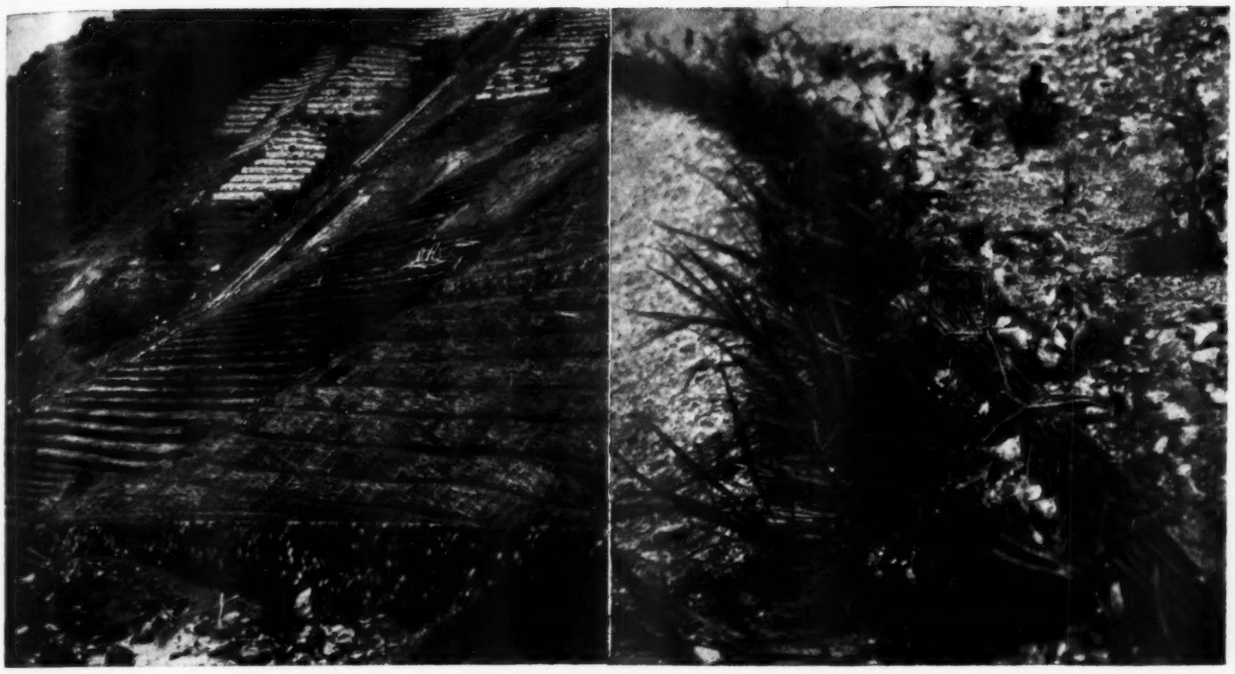


Fig. 1 (left). *A variety of terracing methods, using masonry, fascines and wicker work.* *Fig.* 2 (right). *Turfing of steps, with seedlings planted on the terrace*

plentiful supply of stone available in the immediate neighbourhood. Walls are sloped at a gradient of between 3 : 10 and 5 : 10 and vary between 0.7 to 2 m. in height.

In places where the ground is too loose, owing to weathering, or because it is frost-bound, terracing is usually unsuccessful and it is necessary to blanket the whole hillside. The slope is covered with fascines, straw, *Torreya nucifera* etc. or with a network of corded bundles of the same materials held down with stakes. (See Fig. 4.)

Depressions and gullies on hillsides where water flows down are very prone to erosion and have to be specially protected. Channels are constructed which may be either of a trapezoid or arc cross-section. The former type of channel in stone is used where there is a great deal of water and an arc of turfs where the flow is less. Both kinds of channel are normally roofed with stone or turfs. The bed of the lower parts of the channels is usually lined with solid stonework, similar to dam construction.

Main channels are mostly provided with stone benches at suitable intervals, of a sufficient height to control the flow of water. As a general rule, a fanwise pattern of branch channels, connected by transverse terraces, runs into the main channel. (See Fig. 5.)

These channels serve to drain off the surface water, but sometimes it is also necessary to drain off the subsoil water. In this case, the usual practice is to bury closed conduits at an appropriate depth in the ground. A ditch is dug and one or two cylinders of wire laid in it and covered over with gravel until the ditch is filled. The cylinders are secured by wooden stakes driven in at intervals of about 2 m. If it is not too costly, the ditch is sunk deep enough to reach rock level, otherwise conduits, which are merely ditches filled with buried fascines or gravel, must often suffice.

Planting and Seeding

Species used

Amongst the tree and grass species favoured for erosion control in Japan, the pines *Pinus densiflora*, *P. thunbergii* and *P. rigida* have all been used from ancient times. They are unsuited for the thin, dry soil of the upper parts of hill slopes, but are useful for the lower slopes and valleys. Alders (*Alnus japonica*, *A. hirsuta*, *A. firma* and *A. multinervis*) are widely used, especially to act as nurse trees to the pines. *Robinia pseudoacacia* is also widely planted at the foot of slopes, beside a stream or river, or on embankments. The trees grow rapidly and provide a very good check against soil slip; they produce useful firewood and wood for charcoal. Oaks, particularly *Quercus dentata*, have deep roots and therefore hold the soil excellently, but they are of slow growth. They are usually put in under a cover of pines and alders.

Populus spp. and *Juniperus* spp. grow quickly and are commonly used to protect river banks and stream beds. *Prunus serrulata* takes root well and grows even on sharply sloping bare ground. *Castanea crenata* grows rapidly and retains the soil very well. *Lespedeza bicolor* is effective where it is difficult to establish cover by ordinary planting. Other useful species are *Amorpha fruticosa* and *Acacia* spp.

Among the grasses used are *Miscanthus sinensis*, *Spodiopogon cotulifer*, *Artemisia vulgaris*, *Indigofera pseudotinctoria*, *Microles pedeze striata* and, more recently, *Festuca elatior* var. *arundinacea* and *Eragrostis curvula*.

Planting

Actual planting is usually carried out by setting out seedlings on the terraces, direct seeding being employed only where planting is likely to prove a failure.

Planting time varies with locality and with the general progress made in site preparations, but it is generally done in the spring, from February to May, or, in localities where autumn planting

is possible, after the leaves have fallen.

The planting hole is made 25 to 30 cm. wide and deep and the seedling is planted at a fair depth. The number of seedlings planted per hectare is at least 5,000 to 6,000 and more often 10,000 to 12,000, giving 15 to 20 trees per 10 m. of terrace, although the spacing varies with the species and the particular site. Two-year-old seedlings, not transplanted, are used in the case of the pines, usually mixed with *Alnus firma*. For the latter and *Robinia* one-year seedlings are used. When vegetative cover has to be restored on denuded land as rapidly as possible, woody shrubs are closely planted between the trees and sometimes grasses are sown or planted as well. The slopes between terraces may also be planted and the outer edges of the terraces often protected by planting *Torreya nucifera*.

Fertilisers

As fertiliser, ammonium sulphate, calcium superphosphate, straw ashes, wood ashes and, recently, solid or granular chemical fertilisers are commonly used. The usual dosage is 30 to 60 g. per tree. Good results have been obtained by laying compost and solid manure, the effectiveness of which is long lasting, in ditches 20 to 30 cm. wide.

Seeding

Direct seeding on the terraces is carried out with a mixture of seed, calcium superphosphate, ammonium sulphate and soil mulch spread evenly and then covered with earth. To prevent the ground from becoming too dry, a thin layer of straw is spread over a seeded surface.

To seed a terrace with *Lespedeza bicolor*, a mixture of seed (treated to hasten germination), ashes and calcium superphosphate is broadcast on the terracing behind the *Torreya nucifera*.*

Seed of perennials and shrubs is also frequently sown on the slopes between terraces. In this case, a similar mixture is scattered in raked lines or spots and the seeded portions are then covered with straw. Where the slope is gentle, the seed mixture may also be deposited in holes 20 cm. in diameter and 5 cm. deep, cut one per sq. m., and again covered with straw.

Where the ground is very poor or has been greatly denuded, no attempt is made to plant up directly with seedlings. The method followed is to try to establish a natural succession of vegetation, to create an environment in which forest trees can later develop. The method is as follows:

* A mixture of 1.35 kg. of seed, 7.5 kg. of ash and 7.5 kg. of calcium superphosphate is sufficient for 180 m. of terrace.

Firstly, broken and loose earth is scraped off the slope into depressions in the hillside or down to the valley, leaving a firm, smooth surface for seeding. At key points turfed channels and stone revetments are constructed. Then horizontal steps 20 to 30 cm. wide are cut in the slope and spaced at intervals a little less than the length of the straw sheaves which will be used to cover the slope. These steps afford a foothold for the planters and serve as the points where the ends of the straw covers meet and can be tightly pressed down with earth to hold surface soil and check rainfall run-off. On the surface thus prepared numerous small holes are made with a hoe or, where the slope is very steep, shallow horizontal lines are raked into the slope to hold the seed mixture which is to be used.

This mixture has seeds of hardy and less tolerant plant species and plants of spreading and erect growth habits mixed together, with forest tree seed added. The following is a common mixture for the latter: *Podocarpus nagi*, *Arundinella hirta*, *Cypbopogon goeringii*, *Lespedeza cuneata*, *Lespedeza bicolor*, *Alnus hirsuta*, *Pinus densiflora*, *Pinus thunbergii* and *Quercus variabilis*. These tree seeds are first put into a cloth bag and soaked in water to force germination.

The whole seed mixture is mixed

Fig. 3 (left). *Simple terracing.* *Fig.* 4 (right). *Blanketing a whole slope*

Fig. 5 (left). *Hillside drainage channels.* *Fig.* 6 (right). *' Vegetation blocks ' set out on a slope*

with wood ashes of equal or double quantity and then further mixed with a combined fertiliser (calcium superphosphate, ammonium sulphate and wood ashes) and sandy loam, exact proportions having been worked out for the various components and for the quantities required per surface area to be seeded.

The whole mixture is eventually scattered on the slope and pressed down with a tamping board. Immediately after an area has been seeded specially selected forest tree seed, such as *Quercus variabilis* and *Q. acutissima*, may be sown in 2-cm. holes at a spacing of one seed per sq. m. Then thin layers of straw are laid over the surface, the ends being packed down securely with earth.

If forest tree seed is not sown directly with the first plant mixture, the tree species are introduced by planting in the year following the establishment of a vegetative cover.

'Vegetation blocks'

An ingenious method of combining the advantages of both planting and seeding has been devised by an officer of the Maebashi Regional Forestry Office. It involves the use of ' vegetation blocks ', which can be set out either on a terrace or on a slope, and result in the rapid establishment of a vegetative cover. (See Fig. 6.)

To make the ' block ', a composite mixture is kneaded together and then compressed in moulds to produce a ' brick ' 33 cm. long, 20 cm. wide and 2 cm. deep. The mixture is composed of earth (graded sand and soil with a considerable amount of A-horizon), fertiliser (compost, ammonium sulphate, calcium superphosphate, fibre of straw and dried grass), clay and water.

Five holes, 2 cm. in diameter, penetrate the block (made at the time of moulding) to allow stakes to be driven through the block to anchor it to the ground. At the same time the upper surface of the block is pitted with 300 small holes (top dia., 6 mm.; lower diameter, 4 mm.; depth, 5 mm.).

A seed mixture with wood ashes, prepared in previously determined proportions suited to the particular locality where work is to be carried out, is spread over the top surface of the block, thus filling up the many small pits, and then the block is lightly pasted over with a clay and water mix.

Finally, the individual blocks are set out on the hill slope and staked down with stakes of *Dentzia crenata* and poplar, which themselves, in due course, set root and sprout.

This article was reprinted, with permission, from *Unasylva*, 1955, **9**, 60.

Photos: FAO

African Agricultural Plan

The first stage of Southern Rhodesia's five-year plan to revolutionise African agriculture is virtually complete, and the next phase was expected to go into operation in April. The £6,500,000 scheme aims at accelerating the implementation of the Native Land Husbandry Act, which provides for Africans in the Colony to own farms instead of sharing land on the present communal basis. The African Welfare Bulletin, published by the Federation of African Welfare Societies in Southern Rhodesia, says it is expected to double the annual cash income of Native families. By April, African conservation peggers will have received their training in survey work and will be ready for duty. Proclamations were being issued applying the Act to cover 62 Reserves and Special Native Areas, and the total area to be affected by the plan will be nearly 26,250,000 acres. It is evident, it goes on, that the field officers of the Native Agriculture Department have a tremendous task on hand. ' Their labours, however, are already being rewarded. Africans are gradually awakening to the economic advantages to be gained by good farming practice ' says the bulletin.

Fig. 1. Attacking an adult swarm with poison bait during a locust invasion of French Morocco, November 1954. This was an exceptionally intense invasion and overwhelming crop damage was caused

Desert Locust Situation 1954–55

O. B. LEAN

(*Plant Production Branch, Agriculture Division, FAO*)

FAO has provided a great deal of manpower and resources in combination with various governments in an effort to combat and destroy the desert locust. This pest was active throughout 1954 and 1955 and there is no sign of its activity diminishing. But the fight against the pest is being continued with increasing vigour. The total cost of the 1955–56 international campaign is estimated at about U.S. $1,500,000.

DEVELOPMENTS of the present desert locust plague to December 1953 and the measures taken to combat it were summarised in previous articles.[1, 2] The desert locust was active throughout 1954 and 1955 and there are no indications that the plague, viewed as a whole, is on the wane. Although the previous articles recorded that the locust had caused no extensive crop damage, despite the expansion of the plague, very serious, though localised, damage was suffered during 1954 and 1955, particularly in north-western Africa.

Towards the end of 1953 there was a marked decrease in desert locust activity in the Eastern Zone of the invasion area, comprising India, Afghanistan, Pakistan and Iran. On the other hand, the infestation in eastern and western Africa was particularly threatening and a severe invasion of north-west Africa was then forecast, though no heavy attack actually occurred until a year later.

Developments in 1954

Early in 1954 the Arabian peninsula was invaded by swarms derived from winter breeding on the Red Sea shores and in the Somali peninsula. Widespread breeding, extending northwards into Jordan, Israel and Iraq, followed and, despite control measures, large numbers of spring swarms appeared between late April and June. Some of the immigrant winter swarms spread beyond Arabia to Iran, Afghanistan, Pakistan and India. Breeding also occurred in these countries, though that in India was restricted.

During the same period other swarms from the Arabian peninsula had moved westwards or south-westwards, resulting in very heavy hopper infestations in British Somaliland, Somalia and southern Ethiopia, and also in Kenya and Tanganyika.

In the summer the movements of the new swarms followed the normal seasonal pattern. Those from Arabia migrated into Africa, particularly the Sudan, but also to Egypt and Eritrea, and some also concentrated in the south-west of the Arabian peninsula. Many of the swarms reaching Africa moved westwards, progressing through

Chad, the Niger Colony and French Sudan to Mauretania, which was reached in July 1954. To the east, Pakistan and India were again invaded.

Widespread breeding developed along the summer rainfall belt and was particularly serious in French West and Equatorial Africa, the Sudan, Ethiopia and Somaliland. The most significant result was a mass displacement of young swarms from tropical Africa to the north-west in October 1954. This movement led to an exceptionally intense invasion of French Morocco (Fig. 1), where overwhelming crop damage was caused. Simultaneously, many swarms were carried out over the Atlantic. The Canary Islands were heavily invaded and large numbers of dead locusts were reported floating in the sea as far north as Lisbon; some scattered locusts reached the Scilly Isles and Ireland. The invasion of North Africa spread through French Morocco, Algeria, Tunisia and Tripolitania, resulting in very heavy spring breeding. Some swarms also reached north-western Egypt.

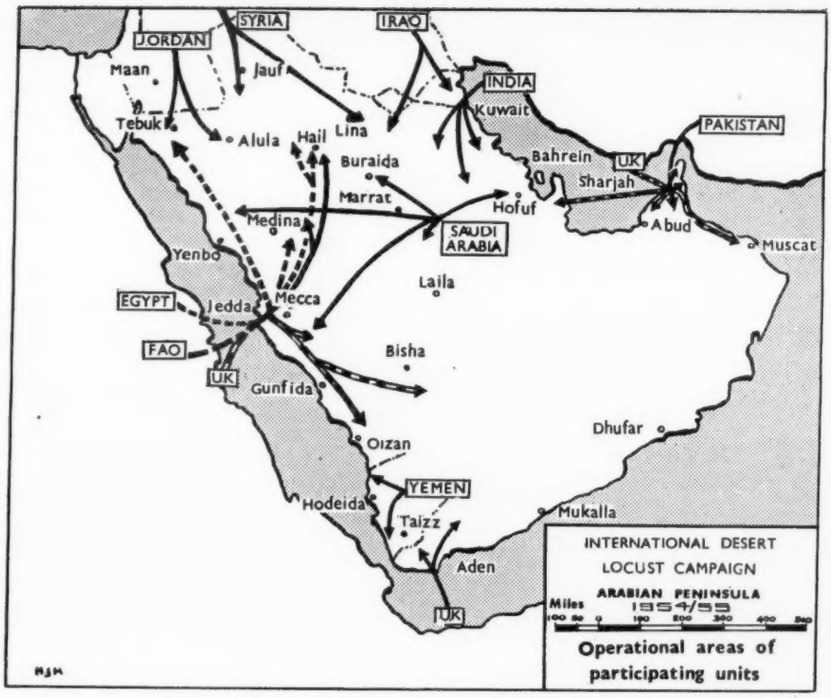


Fig. 2. Map of the Arabian Peninsula showing the operational areas of the control units organised by 10 countries and FAO in the anti-locust campaign, 1954–55

Developments in 1955

In 1955 the situation in the Arabian Peninsula also became critical. Swarms derived from the summer breeding in the Central Zone bred heavily on the south-western coastal plains and the infestation extended gradually inland, with the main 1955 spring breeding occurring across Arabia from east of Jeddah to Kuwait. Swarms produced during the summer breeding in the Eastern Zone invaded southern Iran and eastern Arabia.

In East Africa, owing to the failure of the 1954 autumn rains, the usual breeding did not occur in the Somali Peninsula and the swarms moved south-westward, causing an invasion of, and subsequently heavy breeding from October to December in, Kenya and Tanganyika, with some swarms penetrating the Belgian Congo. Later a northward movement of swarms led to the invasion of Uganda and the Sudan and breeding spread through northern Kenya, eastern Ethiopia and the Somali Peninsula during April and May 1955.

Of the swarms produced by the 1955 spring breeding, those derived from the Arabian Peninsula moved mainly west and south, invading the Sudan and northern Ethiopia, including Eritrea. Countries to the north and east escaped invasion and the whole eastern region remained relatively calm. In the western region young swarms commenced to move across the Sahara in May. As a result of these two major movements, the summer breeding belt from Senegal and Mauretania to the Sudan was heavily infested by July from the west, this breeding area being more or less continuous with that in the Sudan and Ethiopia, which was affected from the east, and the Somali Peninsula, which was attacked from the south. The first swarms of the 1955 summer generation had begun to appear by August in French West Africa and the movement of swarms towards the North African territories began in September. By October some swarms had already reached Algeria, Spanish Sahara and Tripolitania.

It is not easy to summarise the intricate pattern of seasonal swarm movements, sequence of breeding and fluctuations in the intensity of the plague over the whole desert locust invasion area, but the above outline may serve to indicate how, during the period under review, the infestations throughout, from India to the Canary Isles, were inter-related. Secondly, it shows that the plague remains at a critical level. Although at present the infestation is at a low level in the east, potentially serious locust concentrations remain in Africa, threatening again directly North-West Africa and the Arabian Peninsula and indirectly all other areas.

International campaigns

It is equally difficult to review adequately the preventative measures which have been conducted and which have proceeded without interval in one infected country or another. The present article therefore deals only with those international campaigns with which FAO has been directly concerned.

The previous article described how, as a result of a meeting convened by FAO at Damascus in November 1953, a programme for international action in the Arabian Peninsula was initiated. Time proved too short to overcome all the practical and organisational difficulties affecting such a major collective endeavour, yet the results achieved in attacking the 1954 spring breeding in Arabia, and especially the determination of so many countries to participate in the campaign, encouraged the countries concerned and FAO to intensify their efforts.

The progress and results of the 1954

campaign were scrutinised at a meeting of the Co-ordinating Committee for the Control of the Desert Locust in the Arabian Peninsula, convened by FAO in Cairo in June 1954, and later by the Working Party on Desert Locust Control, convened by FAO in Rome in September 1954.

Anti-locust units from Egypt, Iraq, Jordan, Saudi Arabia, Syria, the U.K. and the U.S.A. participated actively in the 1954 campaign. In addition, materials or services were provided by the governments of France, Iran, Kuwait and Turkey. France and the Sudan also contributed cash. The value of all governmental contributions was estimated at about U.S. $230,000. FAO provided vehicles and equipment to the value of about U.S. $100,000 and expended about U.S. $65,000 towards operational costs. It is not a normal function of FAO to act in an operative capacity, nor to finance anti-locust campaigns. The Organisation contributed to the 1954 campaign, and on an increased scale to the 1955 campaign, to help initiate and support the project during the early stages of this international programme. It is, however, a normal rule for FAO to co-ordinate such work and in January 1954 a centre was established at Jeddah to integrate the work of contributing governments with that of the Saudi Arabian Government, which at this time formed its first own anti-locust units.

The Working Party planned intensified operations in the Arabian Peninsula during the 1954–55 breeding season, and the results of the subsequent campaign, reviewed by the First Session of the FAO Desert Locust Control Committee (Rome, April 1955) and, secondly, by its Second Session (Bloudan, August 1955), showed a greatly increased overall efficiency. Despite very heavy breeding across the Arabian Peninsula, great destruction of hopper bands was achieved in all operational areas. Where numbers of hopper bands were estimated, a total of over 75,000 bands were destroyed and in addition Saudi Arabian teams treated a gross area of 254,500 ha. and Iraqi teams destroyed bands covering 276 ha.

The total cost of the last campaign amounted to about U.S. $1,300,000. This expenditure was met by contributions from the following 16 governments and by the League of Arab States and FAO:

Bahrain	Pakistan
Egypt	Qatar
France	Saudi Arabia
India	Sudan
Iran	Syria
Iraq	Turkey
Jordan	United Kingdom
Kuwait	Yemen

A total of 47 locust control detachments were operated by Egypt, India, Iraq, Jordan, Pakistan, Qatar, Saudi Arabia, Syria, U.K. and Yemen, as well as FAO in the Arabian Peninsula. Fig. 2 shows the operational areas of the participating units and their interrelations.

The value of FAO's contribution was over U.S. $300,000 during the past season. Although FAO's contribution was thus greatly increased from that of the preceding season, it is particularly significant that Saudi Arabia itself raised its contribution from U.S. $45,000 in 1953–54 to U.S. $300,000 in 1954–55. During the past season FAO strengthened the staff at its co-ordinating centre at Jeddah to include a Senior Locust Officer, three Locust Officers and an Administrative Officer.

The continuance of the present desert locust plague requires increased vigilance and intensification of control measures. The Second Session of the FAO Desert Locust Committee prepared detailed plans for the 1955–56 international campaign in the Arabian Peninsula and estimated its cost at about U.S. $1,500,000. Implementation of these plans is now in hand.

This article may suggest that FAO's interests in desert locust control is limited to the Arabian Peninsula. Although it has concentrated upon this important strategic area, the Organisation continues to provide limited material assistance elsewhere, *e.g.* Afghanistan, Ethiopia, Iran, Pakistan and Libya. It has also taken steps to intensify international co-operation in desert locust control in northern Africa and Ethiopia.

Preventative policy

It is accepted that the present type of defence against the desert locust, which in the main succeeds in keeping plagues in check, but which involves many governments in heavy recurrent expenditure, is not the rational answer to the problem. Plagues of other species of locusts have been prevented at source and it is hoped that eventually increased knowledge may permit a preventative policy of desert locust control to be put into effect. This approach to the problem received particular attention by the FAO Technical Advisory Committee on Desert Locust Control at its Fifth Session held in Damascus in August 1955 and, in an attempt to direct investigations to this end, FAO is inviting a panel of experts to prepare detailed proposals on the lines along which future work should proceed. Experience has proved that locust plague suppression can succeed only when supported by international co-operation and there can be no doubt that to achieve plague prevention co-ordinated international action will be equally essential.

Reprinted, with permission, from *FAO Pl. Prot. Bull.*, 1955, **4**, 1.

REFERENCES

1. Lean, O. B., *FAO Pl. Prot. Bull.*, 1952, **1**, 2.
2. Lean, O. B., *FAO Pl. Prot. Bull.*, 1953, **2**, 33.

Photo: FAO; Map: M. J. Harris.

Technical News

The May issue of *Manufacturing Chemist* contains articles on ' Glycyrrhetinic Acid ' by Wm. Mitchell, ' Essential Oils in India ', and ' Monsanto Chemicals' New Radiochemical Laboratory '.

Food Manufacture for May includes articles on ' Trace Elements in Foods: I—Lead ' by R. D. A. Polhill, B.SC., A.R.I.C., ' Olive Products in California ' by W. V. Cruess and ' Safety First with Food Machinery ' by Henry Allen.

The contents of *Paint Manufacture* for May will include articles on ' Recent Developments in Epoxy Coatings ' by J. H. W. Turner, 'Anti-fouling Paints Today ' by J. C. Kingcombe and ' Instruments for the Paint Industry ' by E. E. Jelpke and A. G. Walker.

Among articles appearing in the May issue of *Corrosion Technology* are ' Corrosion Problems on the Texas Gulf Coast—Part II ' by A. D. Rust and ' Lanolin as a Temporary Protective ' by H. Silman, B.SC.

Kenya Citrus Orchard Blossoms

To transform the swamp, bush and forest of Kenya's Coast Province into an orchard of citrus fruits is the goal of Government horticulturists now widening their experiments to fire the interest of African farmers.

Six trees of each of 31 varieties of orange, tangerine, lemon, lime and grapefruit form the nucleus of investigations at the Horticultural Section of the Matuga Experimental Station near Mombasa. The object is to improve the quality of locally grown citrus, to reduce the number of trees imported from South Africa, and to increase quantity throughout the whole region.

Up to 1955 trees have been sold largely to non-African growers, but, as commercial nurseries are now beginning to meet their demand for budded material, Matuga has switched its policy to the production of seedling trees only, for issuing exclusively to African areas.

European and Asian growers have, in the past five years, bought between 5,000 and 7,000 budded varieties of citrus trees annually. About the same numbers of seedlings will now be distributed each year, mainly around African settlement schemes, and, as with previous sales, the distribution will be followed up with advisory visits from the Matuga experts. The origin of the seed is from selected local seedling trees nurtured at Matuga.

Observations continue on all citrus varieties established on the Experimental Station, alongside citrus rootstock trials. But beyond these routine activities an overall survey of coastal citrus is in full swing and by the end of the year will have included all aspects of citrus growing throughout the province. A study of the findings on completion of the survey will enable recommendations to be made as to the future policy of citrus growing at the coast.

To maintain a flow of experienced staff to supervise the anticipated expansion of fruit-growing, two annual courses in citriculture are training Department Agricultural Instructors and other Africans drawn from the whole of East Africa.

Kenya-born Mrs. S. M. Wheatley, trained at Reading University, is the Section's chief horticulturist. Her husband, Mr. P. E. Wheatley, is the Section's entomologist.

Mrs. Wheatley with her husband, Mr. P. E. Wheatley, in his laboratory. Mr. Wheatley is the Experimental Station's entomologist

Other investigations

Citrus fruits are not the only concern of Mrs. Wheatley. Her Section embraces investigations and experiments in the growing of mangoes, coconuts and pineapples.

Mrs. Wheatley, in charge of the Horticultural Section of the Matuga Experimental Station on the coast of Kenya, examines one of her orange trees

The Experimental Station, under the overall charge of Mr. W. A. Wright, also deals with general agriculture—maintenance of fertility experiments, general husbandry of crop production, the introduction and testing of improved varieties, better-yielding and disease-resistant breeds, care and improvement of cattle.

Under Mr. Wright's supervision is the nearby Agricultural Training School, where Mr. David Mbotela and two other Africans as his assistants instruct 26 Africans at a time in two-year courses which qualify them to become Agricultural Instructors; they pass on their acquired knowledge to farmers in remote areas of the colony. At the school all is free—classes, board and lodging and uniforms. Practical field work is performed on a 25-acre smallholding, divided into 18 fields, on which two sections of nine fields each experiment with two different crop rotation.

The Matuga Agricultural Training School and Experimental Station promises to prove a dominant factor in the embellishment of Kenya's already rich variety of produce.

H. G. LAYCOCK

Photos: Kenya Information Office.

Ensuring Good Returns to Kenya Cotton Growers

ALTHOUGH 20 years ago many chiefs and headmen in Nyanza had to urge their people to cultivate cotton in the hot, low districts bordering the north-eastern shores of Lake Victoria, today this crop has become so important in the province — ranking second only to maize as an African cash crop in Nyanza—that it is well on its way to becoming a major African industry in Kenya.

As many as 50,000 Nyanza Africans are cotton growers and a large number of others, including Arabs, cultivate cotton on the Coast. Indeed, with 14,000 bales of cotton lint produced in Kenya every year and with six ginneries already operating in Nyanza alone, the position is such that the Government has had to take special measures to protect the growers against abrupt fluctuations in the world prices.

Within the past 12 months there has been a drop in the price obtainable in the world market for the cotton lint exported from Kenya, partly because a large surplus of about 11,000,000 bales of lint has been accumulated by the U.S.A. and this has had an unsettling effect on the world market.

As a protection to the growers, the Kenya Government has now set up the Cotton Board to be responsible for exporting the lint and has built up funds standing at £730,000 for Nyanza and £240,000 for the Coast to subsidise the price to the growers whenever there is a drop in the world price.

The function of the Board, which operates under the Director of Agriculture, is not, however, limited to marketing and subsidising the price to the growers. It has also to undertake development work in cotton districts. In this it is advised by two committees —one for Nyanza and the other for the Coast Province.

Development projects

Price subsidies to growers are financed from the Cotton Assistance Fund, and the cost of development projects is met from general funds of the Board. It is estimated that within the next few months, these will amount to about £224,000 for the Coast Province and approximately £185,000 for Nyanza.

They will be used on such schemes as cotton research work, water supplies, improvement of roads, payment of cotton inspectors and other general benefits for cotton districts.

Already in Nyanza the fund is being used to pay for dam construction, the building of a health centre at Nambare in North Nyanza and the clearing of tsetse flies in the formerly uninhabitable parts of the Kuja-Migori area of South Nyanza.

Cotton growing in Nyakach Location in Central Nyanza. An African farmer and his family harvesting their cotton crop on their smallholding

Diversified farming

Equally important are the schemes taking root at the Coast. A successful campaign to encourage the cultivation of the crop there waged a few months ago by the Department of Information was, for instance, paid for from the general fund, which is also being used to finance a big project to encourage the growers to diversify their farming and not to depend entirely on cotton for their income. In addition, the entire capital cost of the Kwale Technical and Trades School, about £32,000, and the construction of a dispensary at Bamburi, an Arab cotton growing centre, are both being met from the general fund.

There is no doubt that, as a result of the measures now being taken by the Cotton Board with the advice of experienced men in marketing and farming, the industry is being built on a foundation that will enable it to expand and give the growers good returns for their labour even if the world price falls.

JUSTUS N. OLUOCH

Photo : Kenya Public Relations Office, London.

German Tractor Factory for Brazil

A plant for the assembly and manufacture of agricultural tractors, under a licence given by the Karl Ritscher Company of Sproetze, is now being constructed in the Brazilian state of Rio Grande Do Sul, the company's management states.

The plant will start by assembling three types of Ritscher tractors and switch to actual production later. The Ritscher company is a medium-sized tractor and farm machinery producer which now employs about 200 people.

Tractor Factory for Chile

It is reported in Santiago de Chile that, in partnership with Corfo, Fiat propose to establish a tractor factory in the region of Concepcion.

SUPERPHOSPHATE

In the article 'Alternatives to Superphosphate', WORLD CROPS, 1956, **8**, 151, the caption for the illustration should have read 'The response of swedes . . .'

CORRESPONDENCE

We publish below, without comment, two letters received recently by Mr. Norris H. Evans, U.S. representative of WORLD CROPS.

Dear Mr. Evans,

You will be interested in knowing that I have received each year a considerable number of orders from export areas for both my ' American Tomato ' and ' Potato Yearbook ', which I publish. They must practically all come from WORLD CROPS, for that is the only foreign and overseas publication in which reviews appear.

As a rule, I receive 30 or 40 such orders a year.

While I have not made accurate check, it seems that most of these orders come from South Africa, Netherlands, Scandinavian countries and the British Isles

Being in the publishing business myself, it is my opinion that this continued interest is an excellent sign of reader following for WORLD CROPS.

You may certainly use this letter where you wish.

Sincerely yours,
C. S. MACFARLAND,
Publisher.

' American Potato Year Book ',
8 Elm Street,
Westfield,
New Jersey, U.S.A.
11 *August*, 1955.

Dear Mr. Evans,

I refer to your letter dated 20 December, 1955, and I am sorry I could not reply to same earlier, as I was collecting the information on the lines required by you.

We proposed to Messrs. —— International, New York, U.S.A., to utilise WORLD CROPS as a medium for advertising —— for the simple reason that this publication goes to the majority of the tea planters, their managing agents as well as the technical staff. This is the only publication in English giving valuable information on various agricultural matters and at the same time is not highly technical. As such, it is preferred by all for general information on agriculture. However, one must bear in mind that the tea planters do not go through this journal in detail, but read it casually and go into details on articles in which they feel interested. One thing is certain, that this journal is regularly purchased by many planters and is preserved as a set of technical information.

Besides the tea planters, WORLD CROPS is subscribed to by most of the agricultural research institutions and entomological laboratories in India.

An advertisement in this journal would therefore work as a prestige advertisement as well as for furnishing the technical data on use of the material advertised. For details, the reader has got to approach the manufacturers or their distributors in India.

It is very essential that the advertisement must be attractive, preferably in three or more colours, and should appear on the front page or on the page adjoining the index. This is very important, as these pages are seen by every reader of WORLD CROPS.

It would still be better if it is possible to publish articles in WORLD CROPS giving full information regarding —— for eradication of mites. Separate articles should appear for separate uses, *viz.* for tea, citrus plantations, vegetables etc. Such articles can be prepared by the technical staff of —— International, New York. This would, however, take some time and therefore we suggested to Messrs. —— International that advertisements in WORLD CROPS should be started immediately and they may subsequently be followed by articles in the same journal.

As far as tea plantations are concerned, they have their own laboratories, which circulate technical information about various products in the form of tea encyclopaedia. An advertisement in WORLD CROPS, however, reminds them of a particular material which is so useful to them to protect their plantations. It is thus very important to have such reminders before the planters as often as possible.

We hope this little information which we have furnished will enable you to chalk out the programme of advertisement for ——. If, however, you require any further details, please do not hesitate to write to us and we shall furnish reply promptly.

Wishing you a happy New Year.

Yours sincerely,
G. D. GOKHALE.

Bombay Chemicals Ltd.,
129 Mahatma Gandhi Road,
Bombay.
10 *January*, 1956.

Hungary Produces a New Beer Barley

Among new plants produced by Hungarian scientists in 1955 was a new beer barley—FB 104—bred at the Martonvásár Agricultural Research Institute by Béla Fridrich. Experimental and large-scale production tests have shown this barley to be extremely abundant and very adaptable. The Hungarian beer industry experts also consider FB 104 of outstanding quality from the industrial point of view.

New crop varieties

In the same institute, István Manninger has produced the Martonvásár ' record pea '. This type is especially interesting for dry areas, is very hardy and crops abundantly.

In the Iregszemcse farm of the South East-Transdanubian Agricultural Experimental Institute Ernö Kurnik, the director, and Mrs. László Mészáros have refined the ' Ireg Early Striped Sunflower ', claimed to be one of the best productive types in the world. It gives a very large oil yield.

Three new types of potato have come from the Kisvárda farm of the Nyirség Agricultural Experimental Institute — ' Prosperous ', ' Kisvárda Rose ' and ' Lilla '. All three are good croppers.

In the Budatetény farm of the Horticultural Research Institute, Lambert Angeli and his colleagues have produced the ' No. 3 Cecei Sweet Dessert Paprika ', which is a non-pungent variety and therefore valuable for the conserving industry. Removal of the ' veins ' now becomes unnecessary, thus economising in labour.

This year research workers are seeking disease - resistant, firm - strawed autumn and spring wheats and working on refining rye types. Experiments are going on at Sopronhorpács to evolve higher productive sugar- and fodder-beets than the already world-famous types which have been produced.

Small-scale Farming in the West Indies

Continued from page 176

farmers by conventional extension methods alone. Most small farmers still suffer from many of the handicaps discussed above and cannot therefore adopt all the practices required for successful farming, however good their intentions; failure to adopt even one of the required practices can completely wreck the whole system. It is therefore likely that any system proved successful on an experimental unit will have to be extended by means of tightly controlled and adequately financed land settlements on which no other system of farming is permitted. It is to be hoped that when the pioneer settlers have proved by their own prosperity that the system of farming is superior other farmers who have the means and the land to practise it will voluntarily do so. As the idea spreads among small farmers that mixed farming is a practical means of securing a good living from the land, these men will exercise their ingenuity on their own farms to develop a balance of enterprises which suit their own particular conditions best.

If such a change could be achieved in the next generation it would create an economic, agricultural and social revolution in the West Indies. Such a revolution is, in the writer's opinion, quite possible, but only if the economic investigations required to provide the fundamental information are conscientiously carried out and the initial settlements required to apply the proven systems are firmly directed. Talking about mixed farming in general terms will do no good; actual systems that yield good earnings must be developed if the small farmer is to secure a permanent self-respecting place in the community.

REFERENCES
[1]Jolly, A. L., 'Report on Peasant Experimental Farms', Economic Series No. 2, Imperial College of Tropical Agriculture, Trinidad, B.W.I.
[2]Jolly, A. L., *Trop. Agric.*, 195, 29, 172, Nos. 7-12, pp. 172-179.

Potato Production

It was reported recently that world potato production in 1955 was about 10% below the previous year. Figures show production was up in North America but down in most of Europe.

Industrial Crops in Poland

The cultivation of industrial crops is increasing in Poland. Individual small farmers represent some 50% of the producers, and the rest of the cultivation of these crops is accounted for by co-operative or State farms. Growing is on the basis of contracts between the growers and the industries that utilise the plants.

Bonuses

Under these contracts, the government supplies seeds, artificial fertilisers, hot-bed installations and fuel to the producers. The contracts lay down quantities, quality and date of delivery, as well as rates of payment. Bonuses in cash and in kind are also available for producers who deliver quantities over and above the amount they have contracted to produce.

The growers are able to avail themselves of expert advice on growing industrial plants, and to attend courses on their cultivation.

Industrial crops

The success of these incentives may be seen in the fact that the area under sugar-beet, and oleaginous and fibre-yielding plants has doubled by comparison with the prewar figure. Most important among industrial crops today are oleaginous pumpkins, castor-oil plant, poppies, sunflowers, chicory, high-starch-content potatoes, osiers, flax and hemp, and of course sugar-beet. New developments are the greatly increased cultivation of herbs, hops and tobacco. In 1956, for instance, some 50,000 acres of medicinal herbs will be cultivated. The area under hops has risen tenfold since the war, and tobacco production has risen fourfold.

Land reclamation

Good progress continues to be made in land reclamation in Poland. In 1955 over 357,500 acres of meadow, pasture and arable land have been rehabilitated. Over 300,000 acres of meadow, on which amelioration work was begun in the autumn of 1954, have been cultivated in 1955. It is estimated that meadows rehabilitated during 1955 will yield five million quintals of extra hay, sufficient for about 250,000 head of cattle.

Flooding is a long-standing problem in many parts of the country, and in the course of last year embankments were built or repaired along over 100 miles of river, and regulation work was carried out on some 550 miles of waterways.

Repairs and conservation work on drainage and irrigation installations have been done over an area of over 850 million acres.

German Tractor Transfer

Professor Dr. Prinzing, Managing Director of the new Porsche-Diesel Motorenbau of Friedrichshafen, which has taken over the tractor and engine construction of the Allgaier Werke in Württemberg, said at a press conference that the new company's initial capital would be fully provided by Mannesmann A.-G. Porsche would share in the eventual increase of the capital, but Mannesmann would remain the majority shareholders. This was reported by the Agricultural Engineers Association Limited who went on to say that Mannesmann were specifically interested in the production of stationary agricultural engines, and the new company intended to transfer tractor production to Friedrichshafen in the course of 1956 when four large assembly shops would be erected. Building had already commenced, and Mannesmann had invested D.M. 4 million (£350,000) for this purpose.

It was also reported that Dr. Prinzing, who would also remain a member of the board of Porsche, would be assisted by a number of experts from Porsche. For the time being the new company would continue tractor production at the Allgaier Werke, including a light 12-h.p. cultivation tractor, a very light 17-h.p. tractor with an air-cooled engine, and the 22-h.p. tractor based on it; and, finally, a heavy 33-h.p. tractor which was expected to sell very well in export markets.

So far, 40,000 of the above-mentioned tractors which incorporate engines of from one to four cylinders, have been built, and in 1955 the total output amounted to 9,000 units.

Allgaiers would concentrate on machine tools production—orders are in hand for several years' work, from firms of international importance.

A New A.E.A. President

Mr. Lionel Harper, Managing Director of Massey-Harris-Ferguson (Sales) and Massey-Harris-Ferguson (Manufacturing), was elected President of the Agricultural Engineers Association Ltd. on 13 March.

A Canadian, Mr. Harper has spent 19 of his 28 years with Massey-Harris in the service of the British company.

To his new post Mr. Harper brings both practical knowledge of the implement trade and farming, combined with an extensive knowledge of agricultural techniques in England, Canada and the U.S.A.

A British Publisher Reports on the U.S.A.

Since the war Mr. W. Leonard Hill, Chairman of the Leonard Hill publishing group, has made several trips to the U.S.A.; he has travelled many thousands of miles in that country, visiting industrial and research establishments from New York to Texas. He made his last trip just before Christmas and the opportunity was taken by the company to arrange a reception at the Royal Society of Arts in London, during which Mr. Hill summarised his most recent personal impressions of America and the Americans in a lively and entertaining talk. He was introduced to his audience of industrialists, scientists and businessmen by Mr. J. E. Currie, Vice-President of the American Chamber of Commerce in London. Among those who accepted invitations were Admiral Charles Lyman, U.S. Naval Attaché in London, Dr. C. de Fellner (R. W. Gunson [Seeds] Ltd.), Mr. R. H. Minden (Universal Crop Protection Ltd.) and Mr. John Wilder (Agricultural Engineers Association).

Mr. Hill's talk was illustrated with a number of enlarged photographs, several in full colour. He summarised his impressions thus: 'Americans have more spiritual life (than the British), whereas in business they are more effective and materialistic. They have few false loyalties. They rejoice and gain strength in their freedom from hereditary privilege, and they are fair dealers. Their standard of education for life is superior to ours, and their higher education is higher. They do not dissemble. They are somewhat artless'.

Developments in Formosa

It has been reported that, in order to meet the 3% annual increase in population, the Formosa Government is considering two schemes to add to the land area under cultivation. The first would provide for the cultivation of tidelands on the west coast between Taoyuan (Toen) and Kaohsiung (Takao), from which the sea has receded. This area, some three to five miles wide, is believed to amount to about a tenth of the land area already cultivated and to afford a livelihood for 300,000 persons and an annual yield of N.T. $1,400 million (£1 = N.T. $43.5). The second scheme envisages cattle breeding on the tidal grasslands of the Upper Tachia River, approximately 4,000 ha. in extent.

After 24 years of construction, the Yuanling water duct system was completed in March 1956 and opened by the Governor of Formosa on 5 November. Designed both for flood control and irrigation, it is 25.4 km. long and will irrigate 2,000 ha. of paddy fields, thus increasing the value of the land by over N.T. $28 million and the paddy yield by some 13,000 metric tons annually.

A dyke to control the waters of the Ta-An River in Taichung County was completed in late July with labour furnished by discharged Servicemen. The dyke is 3.7 km. long, cost N.T. $3 million and will benefit some 54,000 acres of neighbouring paddy land.

The introduction of new crops to diversify the economy is a constant theme. At the beginning of October Taiwan National University and the Monopoly Bureau agreed on a plan to promote viticulture in central Formosa: the necessary experts and research facilities will be provided by the university and the capital and plants by the bureau, which will use the fruit for wine-making. (At present it produces rice wine, beer and some local liqueurs.)

Sir James Turner

The Council of the National Farmers' Union has unanimously elected Sir James Turner of Anston, Sheffield, as President for 1956.

This will be Sir James' twelfth consecutive year of office.

The Council also elected Mr. Harold Woolley, of Hatton Heath, Cheshire, as Deputy President and Mr. Lionel Du Pre of Beacon Farm, Bainton, Driffield, Yorkshire, East Riding, as Vice-President.

Sir James was first elected in 1945 at the age of 37; he was then the youngest President ever to hold office. Sir James joined the Union in 1928 as Branch Secretary for Worksop. In 1937, before he was 30, he became Chairman of Nottinghamshire County Branch and held that office for three successive years.

He was deputy delegate for Nottinghamshire to the Council from 1936 to 1942 when he became a delegate. In 1944 he was elected Vice-President of the Union.

In 1944-45 Sir James led a delegation of U. K. farmers to the Dominions. In 1946, when the International Federation of Agricultural Producers was formed, he became its first President, and was re-elected in the two following years.

He has been on several official missions to the U.S.A. and Canada, attending conferences of farm organisations as President of the N.F.U. and of I.F.A.P.

Sir James' other appointments include membership of the Council of the R.A.S.E., the Agricultural Improvement Council, the Agricultural Research Council, the Joint Advisory Council, the Dollar Exports Council and the British Productivity Council. He is a Freeman of the City of London and a Liveryman of the Painter Stainers Company. He graduated B.Sc. (Agriculture) at Leeds University in 1928.

He received his knighthood in January, 1949, and the honorary degree of LL.D. at Leeds University in November 1952.

Open Day

The National Vegetable Research Station, Wellesbourne, Warwick, England, is proposing to hold its first 'Open Day' on Tuesday, 5 June, 1956. Growers and others will be able to attend.

Agricultural Resources of the World

Vol. I of ' Atlas of the World Resources '. By William van Royen. Pp. 258, with 338 figures. New York: Prentice-Hall Inc. 1954. 84s.

The geography of agriculture may be treated in several ways. The distribution of crops is determined in part by conditions of climate, in part by soil, by man's knowledge of the control of pests and diseases, by costs of production, by local and general demand and by freight charges or facilities for transport. An atlas designed to show the distribution of crops and stock may restrict the aims to illustrating the known distribution and this has been the classical method of presenting distribution data in most of the older atlases. There has then been a divorce between illustration in the atlas and analysis and explanation in the textbook. The textbooks themselves have been specialised, tending to explain crop distribution in terms of climate, or soils or economic factors and a synthesis of these aspects of the subject has seldom been made, largely because analysis must precede synthesis, and analysis is the work of specialists. This first volume of the 'Atlas of the World's Resources ' is not only an attempt to make such a synthesis, but is remarkably successful.

The atlas is divided into sections giving each crop and stock animal individual treatment. The number of crops described is very large and ranges from wheat, maize and rice on one hand to asparagus, lima beans and cucumbers. The author has allowed for the disparity between acreages devoted to the different crops by different detail of treatment and the discussion of the smaller crops, largely vegetable crops, is unfortunately mainly concerned with distribution in the U.S.A. and Canada. This is, however, a rather minor criticism, for the treatment of the major crops lacks any national bias where it is avoidable. It is unfortunate that good statistical data is not available for Russia and China and in consequence the values quoted for these countries may lack accuracy.

The scope of treatment of major crops may be illustrated by that of wheat. The species are described, chromosome numbers given, and there is a brief discussion of the places of origin of the different forms and the regions of origin are shown on a special map. Temperature and moisture requirements are discussed; vernalisation is mentioned, but not photoperiod. There is a short note on soil types and on quality. The distribution of areas producing wheats of different qualities is mapped. There follows a history of the spread of the crop and detailed consideration of its growth, cultivation and production in various parts of the world. Altogether the account of wheat runs to about 11,000 words and is illustrated by 30 maps, several of them full page size. In addition to those already mentioned, there are maps of the world acreage, and of production in the U.S.A. and Canada, the average yield per acre, and spring and winter wheat acreage dates of seeding and harvesting supplemented by detailed maps of Europe and the adjacent countries. These are followed by maps of areas in which wheat distribution illustrates special points of interest; there are such maps for China-Manchuria-Korea, India, Japan, Argentine-Chile-Uruguay, Australia and South Africa. Finally, the account of wheat, like that of many other crops, is illustrated by diagrams of marketing channels, which are fascinating to the non-economist.

The account of wheat concludes with a list of 26 references, which are sufficient to lead the reader into the literature of phenology, genetics and crop evolution, the physiological reactions to environment and economics.

The standard is high, at times astonishingly so for a book of such immense scope. The expert is bound to find points to criticise on every page, in particular each specialist may well feel that his field has been treated superficially. However, the nature of the book is such that any specialist will find a concise, well-written account of those fields relevant to his own in which he cannot hope to specialise.

The atlas is printed in black and so could not make use of many recent advances in cartography. However, the advantages of colour are largely that they allow several classes of information to be printed on the same map without confusion. In this volume the number of maps is so great that this problem is evaded—the rule becomes ' one map, one job .'

The reviewer finds one annoying cartographical convention. This is the presentation of information about distribution by means of circles centred on the centre of distribution within each country. These circles can become so very large, *e.g.* that for the production of maize in the U.S.A., that the circle encloses Hudson's Bay. Likewise the circles showing the world distribution of mules and asses suggests that asses are abundant in the Irish Republic and absent from Northern Ireland.

Only a fifth of the book is concerned with the distribution of stock and the treatment is a little less detailed than that for the crops—yet it contains in condensed form immensely valuable data.

The book concludes with a list of selected general references. There is no index and a very brief contents list. However, this detracts little from the book, for the arrangement is so logical and clear that no difficulty should be found in using this as a reference book.

In conclusion, it should be said that, though some pages of this volume are ' textbook ' and other pages are ' atlas ', at no point can it be considered that the maps are there to illustrate the text or the text to comment on the atlas. The marriage is ideal.

JOHN L. HARPER

A List of Insect Pests Recorded in South Pacific Territories

At the Plant and Animal Quarantine Conference sponsored by the South Pacific Commission, which was held in Suva, Fiji, in April 1951, the Conference recommended that a list be prepared of the pests affecting plants in the area of the Commission's activities. The lists in the paper have been compiled by several delegations. The systematic list gives the pest species in alphabetical order of the orders, families, genera and species. This work was prepared as Technical Paper No. 79 by L. J. Dumbleton and was published by the South Pacific Commission, Noumea, New Caledonia. Price 6*s.* 0*d.* sterling.

Advances in Agronomy

Vol. III. Edited by A. G. Norman. Pp. 431. New York: Academic Press Inc. 1955. 70s. 6d.

A welcome feature of this volume of 'Advances in Agronomy' is a return to the principle of including contributions from countries outside North America. The subject matter is rather heavily weighted in favour of the pedologist, in that six of the 10 chapters deal with soil. However, an editorial defence of this policy is made and this is based on the importance of soil conditions in general and nitrogen in particular and the common origin of four chapters as contributions to the Soil Microbiology Conference, 1954, is emphasised.

Three chapters, entitled respectively 'Green Manuring Viewed by a Pedologist', 'The Enigma of Soil Nitrogen Balance Sheets' and 'Mineralization of Organic Nitrogen in Soil', serve to emphasise the importance and difficulties of maintaining a high nitrogen status in agricultural soils and problems requiring further investigation. A contribution entitled 'Mineral Nutrition of Plants as Related to Microbial Activities in Soils', is of interest in showing that 11 factors affecting ion absorption from the soil must be influenced by microbial activity. However, in no case are the precise effects of micro-organisms on these factors known, and at present it is possible to do no more than speculate on their importance. This disturbing state of affairs is emphasised in an exhortation to microbiologists entitled 'The Place of Microbiology in Soil Science', where the author pleads for further attention to be paid to the significance of interactions between soil, soil organisms and crop plants. A chapter on soil aggregation points to the probable importance of micro-organisms in aggregation and deals also with the effects of both natural organic compounds and synthetic soil conditioners.

The other four chapters are more directly concerned with crop production. 'Recent Changes in Swedish Crop Production' is a historical account of Swedish agriculture from the introduction of crop rotation 250 years ago to the present day, with particular emphasis laid on developments in the last 20 years.

A chapter on sugar-beet improvement in the U.S.A. gives a most interesting account of the introduction of beet growing, its early decline, owing to disease, and the remarkable achievements of the plant breeders in producing high-yielding, disease-resistant types which have secured the sugar-beet industry in the U.S.A.

'Plant Introduction as a Federal Service to Agriculture' is a short history of the Section of Plant Introduction and a description of the aims and work of the Section in the U.S.A. and in exploration overseas.

A chapter entitled 'Weed Control in Principal Crops of the Southern United States' will interest all concerned with the rapidly advancing field of selective weedkilling. The consistent accompaniment of local common names by their scientific counterparts greatly helps the overseas reader. Lastly, the whole volume is enlivened by numerous half-tone figures which are both well chosen and of high quality.

R. L. LUCAS

Experimental Progress in Brazil

Under three main headings, 'Coffee, Horticulture and Plant Chemistry', 'Coffee Processing Investigations' and 'Agricultural Chemicals', this booklet outlines results of various experimental programmes directed towards the improvement of production and processing of coffee and the study of agricultural chemicals, particularly chemical brush control in pastures. The authors of this work are J. C. Medcalf, W. L. Lott, P. B. Teeter and L. R. Quinn, and it is published by the IBEC Research Institute, 30 Rockefeller Plaza, New York 20, New York.

*

Pests and Diseases of Foodstuffs in Store (Europe and Mediterranean) 1953-54

This report is divided into three sections: insects and mites; fungus diseases; rodent pests. From the economic standpoint, the damage done to stored foodstuffs by insects and mites is certainly the most serious. In the appendix to this volume various species mentioned in the reports of the various countries have been listed.

In most of the national reports the information has been limited to the pests and diseases of foodstuffs which endure long storage periods, chiefly grains, dried fruit, tobacco etc. In some cases, however, damage (mostly caused by fungi) to seasonal stores of such crops as potatoes, onions etc. has also been mentioned. This report was published in Paris, 1956, by the European and Mediterranean Plant Protection Organisation.

*

Game and the Farmer

This booklet published by the I.C.I. Game Research Station, Fordingbridge, Hampshire, attempts to outline the everyday methods which will turn a farm, where game is at a low ebb, into a productive and enjoyable shoot.

*

Plant Growth and the Weather

This booklet is an account of a lecture delivered at the University of Nottingham by F. L. Milthorpe, M.SC.(AGR.), PH.D., D.I.C., on 14 October, 1955. It briefly surveys two possible manipulations of the weather which should give higher yields to the farmer. The first of these is the wider use of irrigation; the second, raising the temperature during the day by sheltering the crop from wind. Price 1*s.* 6*d.*

*

Weed Control Handbook, 1956

This booklet presents information about the types of sprays commercially available and on what crops each could be used with safety. The handbook classifies all weedkillers in common use in Great Britain and sets out the agricultural and horticultural crops on which each type of herbicide can safely be used, at the same time indicating clearly the weeds which can be controlled by each type of chemical. Other sections of the handbook deal with application problems, such as spraying procedure, how to minimise the risk of spray drift and decontamination of the sprayer. New chemical and legal aspects of spraying are also discussed. This booklet is issued by the British Pest Control Council, Cecil Chambers, 86 Strand, London, W.C.2. Price 5*s.* 0*d.*

German Mower

The Agricultural Engineers Association Ltd. report that the Stockey and Schmitz Co., of Gevelsberg, has developed a new special mid-mounted mower for Ferguson tractors. The ' Simplex ' mower, as it is called, is driven by the tractor's p.t.-o. and the lifting of the cutter bar is performed by means of the tractor's hydraulic lift.

The mower can be attached and detached easily and in a matter of minutes, as only two holding brackets are used to fit the ' Simplex ' mower on to the tractor. The mower has been tested both in European and other countries.

Million-acre Sugar Scheme

A major irrigation scheme, which would practically cut out the need for the Federation of Rhodesia and Nyasaland to import sugar, is in the blueprint stage. It involves a million acres of land.

This site is downstream from the Kariba Gorge and could possibly mean a maximum length of 100 miles of concrete-lined canals.

On 25 February the Director of Irrigation for Southern Rhodesia, Mr. R. H. Roberts, told a Salisbury newspaper that they were still awaiting the production of an aerial contour map. He thought this job could be completed within 12 months and a team of soil chemists should then move in to take samples and decide which areas are worth irrigating. Mr. Roberts emphasised the need of a very full economic survey, similar to the one carried out on the Sabi Valley scheme, before the irrigation plan could be fully assessed.

The best possibility of obtaining the water needed for irrigation, he thought, would be to erect pumps downstream. The pumps could be put in, unit by unit, as the irrigation progressed. He thought sugar would be an ideal crop for the area and would reduce the amount of sugar needed to be imported. Last year the Central African Statistical Office estimated that 44,000 tons of sugar were required for consumption in the Federation and 2,000 tons would be available from local crops. By 1970, 70,000 tons would be needed.

The Plant Cultivation and Acclimatisation Institute in Poland

This Institute was established in 1951 and in the five years of its existence has produced results of great value to practical agriculturists in Poland. Principles of artificial pollination of rye, maize, sunflowers, buckwheat and lucerne have been elaborated, and successful methods of vegetative crossing for cultivation of vegetables, clover and potatoes have been evolved. Another subject of study has been the rapid propagation of potatoes from tuber sprouts.

New varieties

In the course of its five years of existence the Institute has cultivated over 100 new varieties of plants, including a wheat with outstanding baking qualities, a type of early-ripening fodder maize, a variety of fodder lupin, and several types of high-disease-resistant potatoes.

On the acclimatisation side, work is in progress on the production of varieties of rice, cotton and other fibrous and oleaginous plants capable of enduring the climate.

Other problems engaging the attention of the Institute's workers are cultivation of corn in light soils, development of leguminous plants whose pods do not burst or drop off, and production of types of sugar-beet with short roots, which are easy to gather.

Fourteen local stations contribute to the work of the Institute on special problems, and there is close liaison between them and local farmers.

Ethiopia and Nile Waters

The semi-official journal, *Voice of Ethiopia*, has stated that Ethiopia is now obliged to revise her Nile water policy, reserving the portion to which she is ' rightfully entitled '. According to international experts, this is 50% of the 73,000 million cu. ft. coming from Ethiopia out of a total average Nile flow of 85,000 million cu. ft. per annum.

Egypt's projected dam is basically affected by the present decision.

Important Cereal Discovery

An important discovery showing the reason for the resistance of certain cereals to powdery mildew fungus, a very serious disease, has been made by a Sydney University scientist. He is Prof. N. H. White, Associate Professor of Plant Pathology in the University School of Agriculture. His discovery has attracted world-wide interest, geneticists overseas and in Australia using his results to establish new resistant varieties. Wheat and barley are among the cereals that may be seriously affected by powdery mildew.

Professor White's research has shown clearly that resistance is due to the sensitivity of the mesophyll cells of leaves of cereal plants to the presence of the fungus. Even in the very resistant varieties of cereals, the fungus penetrates the leaf tissue of the host plant, but in the resistant varieties the tissue beneath the point of infection is extremely sensitive to a poison produced by the fungus.

This poison causes the leaf tissues to collapse in small pockets around the infected spots and thus further growth of the parasitic fungus is stopped. In a susceptible plant the infection takes place, but the leaves are not sensitive to the poison. There is no collapse around the infected spot and the fungus continues to grow at the expense and vigour of the whole plant, so that it fails to produce the normal amount of grain.

Sugar Factory for Ceylon

The Gal Oya Development Board has invited tenders from experienced international firms for the construction of a sugar factory in Ceylon. The factory, to be located on a 10,000-acre site in the Gal Oya in eastern Ceylon, is expected to produce 30,000 tons of sugar annually. Annual consumption in the country is 150,000 tons. Sugar-cane will be grown in the Gal Oya.

The successful applicant will be asked to act as manager for a limited liability company which the Government will set up for the purpose. The foreign firm will also have to contribute a portion of the 30 million rupees the project is estimated to cost.

MACHINERY AND EQUIPMENT

Rhino Tractor

Invented by Elie P. Aghnides and manufactured by Marmon-Herrington Company Inc., 1511 West Washington Street, Indianapolis, Indiana, U.S.A., the ' Rhino ' is the first amphibious vehicle successfully to traverse paved roads, mud flats, marshes, sand and rough terrain. It can climb 65% grades and travel down highways at 45 m.p.h. With 'Hydrojet' propulsion the 'Rhino' may also be operated and manoeuvred in deep water. This tractor has a pair of hemispheroidal hollow spun aluminium wheels in front, and a smaller pair in the rear. For highway operations only the narrow rubber tread touches the road. In soft places the traction area is increased with every inch of sinkage of the hemispheroidal wheels. These wheels and the watertight body make it possible for the ' Rhino ' to float in deep water. Power and steering in the water are provided by the 'Hydrojet', which allows the 'Rhino' to turn easily in its own length.

Chief use to date has been in logging and agricultural operations.

This information was provided in *FAO For. Equip. Notes*, C.11.55.

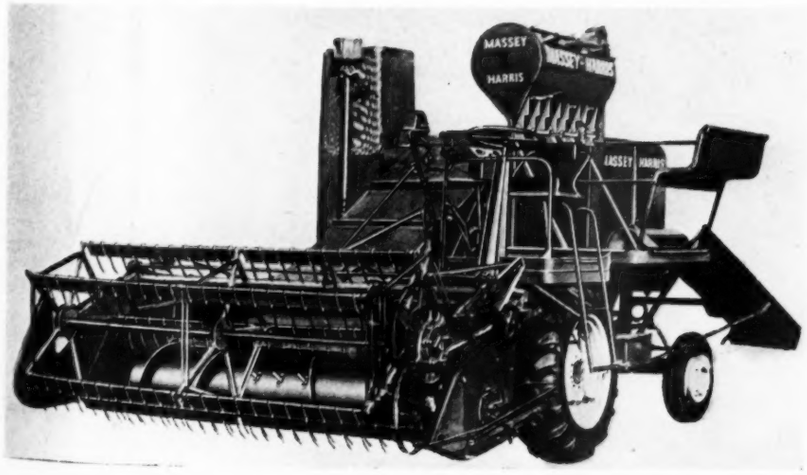
The ' Rhino ' tractor is claimed to be the first amphibious vehicle to traverse successfully paved roads, mud flats, marshes, sand and rough terrain

Self-propelled Combine

Many new points are claimed in favour of the improved Massey-Harris 780 self-propelled combine (Massey-Harris-Ferguson, Coventry, England). Three widths of cut, 8½, 10 and 12 ft., reliable V.O. or diesel engine power, and tank or bagger models are available.

The new features include an independent reel adjustment, operated from the tractor seat. Vertical and horizontal movement is provided to cater for crop variations, such as fields where some of the grain is standing and the other lodged. The combine also features a hydraulic system that allows the operator to lift and lower the table and to change ground speed instantaneously. Speeds can be changed immediately to suit varying crop conditions and to maintain constant speeds up hills and on inclines.

Various accessories are available; these include a Massey-Harris Rausendorf straw press, a straw spreader and a pick-up attachment.



The speed range of the Massey-Harris 780 self-propelled combine is 1–7 m.p.h., with 24 variations. The overall length is 23 ft.-5 in. and the overall height 11 ft. 2 in.

Universal Paper Container

William Palfrey Ltd., of Palfrey House, City Road, London, E.C.1, believe that the use of sacks made of paper brings definite advantages to both consignor and consignee. They claim that their multi-wall ' Palfsacks ' are cheap enough to be used as strictly one-way containers, so releasing time and money normally assigned to checking and renovating returns. This means, also, that each sack used is completely free from impurities which might contaminate its contents. The outer paper layer will resist moisture seepage and can, of course, be printed with full colour advertising material—brand names and so on.

Sacks for the chemical, fertiliser and milling industries can be made with chemically treated linings, or with linings made from other materials. Such a sack is the polythene-lined ' Palfsack '. This is built up of a number of layers with combinations of wet-strength paper, bitumen-laminated paper and polythene-coated paper. The result is a sack which:

(1) Is vapour- and moisture-proof.
(2) Is resistant to greases and free acids and alkalis.
(3) Is tasteless, odourless and non-toxic.
(4) Will retain its flexibility at temperatures as low as –70° C.

The list of products for which modern paper sacks are used is as wide as the scope of industry itself. It

The Boughton FM tractor winch is of the non-reversing free-drum type. The FMR incorporates a reversing gear box, which is mounted on the tractor frame. This gear box provides the alternative of over or under winding together with power reverse

includes plastics, potatoes and coal; stone dust, feeding meals, dried grass and dried blood; dry colours, ice, dried milk and starch; and many of the varied products of the chemical, fertiliser, milling and furniture industries. Some of these manufacturers use standard sacks, but many others have had sacks compounded to meet the requirements—both in size, shape and robustness—of their particular products.

Versatile Excavator

The Pippin excavator (Pippin Construction Equipment Inc., White River Junction, Vermont, U.S.A.) has been engineered for maximum strength to make full use of its tremendous hydraulic power for rapid digging under the most difficult conditions. It digs over 10 ft. deep, loads into high trucks, reaches 17 ft. behind the tractor and swings 12½ ft. either side of centre.

Individual control of the separate hydraulic stabilisers, together with increased downward pressure on the stabiliser pads permits quick, rigid levelling of the tractor to maintain a plumb ditch on a hillside or on uneven ground.

The greater reach of the Pippin provides a maximum of excavating without moving the tractor. Even when fully extended large ' bites ' are possible due to the tremendous power at the bucket. Roots, rocks or hard ground are no obstacle.

The wide swing of the boom permits piling of dirt farther from the excavation. This not only prevents the dirt from falling back in the hole and provides walking space around it, but facilitates truck loading.

The Pippin's extra high lift is essential for loading over the sides of the highest trucks. This height, coupled with the power and rigidity of its design, also permits lowering of septic tanks, large pipes or other heavy loads. With the shovel bucket, the digger is converted to a powerful shovel in 5 minutes.

Tractor Winch

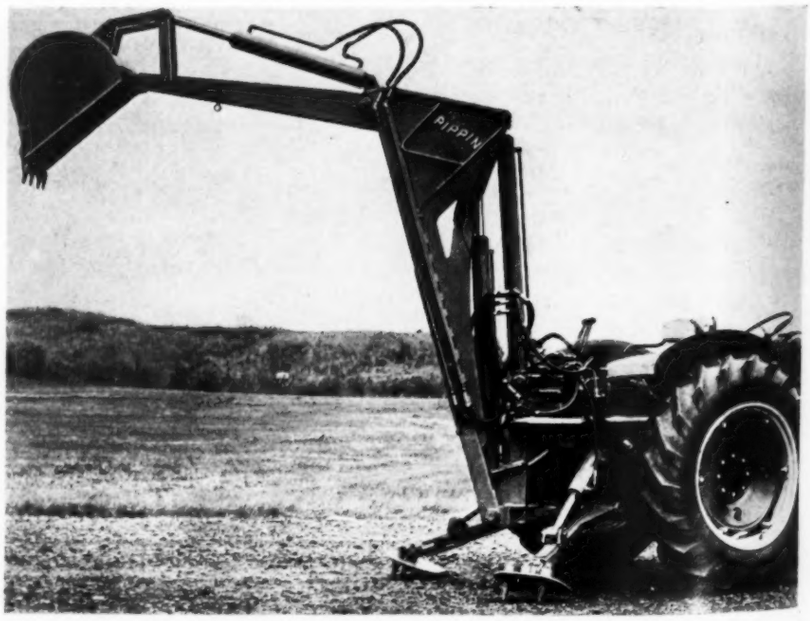
The Boughton Winch Type FM (T. T. Boughton and Sons Ltd., Amersham Common, Bucks, England) has been specifically designed to be mounted on the front end of tractors and is generally suitable for any tractor which has the belt pulley at the side.

It will be found of great value for self-recovery purposes when the tractor becomes stuck in mud or snow, since the driver can readily pull out the winch rope to winch the tractor forward.

The Boughton front-mounted winch is a compact, self-contained unit, which fits to the front end of the wheeled tractor and is driven by Renold Duplex chain from the belt pulley position, and incorporates two reductions along the side of the tractor to shorten the chain centres. All chains are fully guarded; adequate and simple adjustment is provided for both chains.

An internal ring gear and pinion permanently meshed and totally enclosed provide the final drive. The pinion gear being mounted on opposed Timken bearings and the internal ring gear bolted direct on to the all-steel drum. Lubrication of the winch is by oil bath. Oil seals are fitted to prevent oil leakage, and to exclude dirt and moisture etc.

The rope drum is free running and mounted on opposed Timken bearings.



Features of the Pippin excavator include centre-pivoted dipper stick for rigidity and more bearing surface; all major wearing points are bushed with hardened alloy-steel bushings; a range of attachments to increase versatility

Tapered and rounded flanges help to give prolonged rope life.

A two-shoe, internally expanding brake operates on a 12-in.-dia. drum. This brake mechanism is enclosed in one end of the rope drum, the final drive being arranged at the other end. This arrangement gives a neat appearance and the rope cannot become entangled in moving parts. Positive rope fixing is provided in drum flanges.

Tractor-tyre Girdle

A new type of girdle, manufactured by Edge & Sons Ltd., Shifnal, Salop, England, was demonstrated recently. The girdles are simple, each consisting of two plain chains with shackle coupling, carrying a series of cross bars of ¾-in.-square steel bar. They are easy to attach or detach and, moreover, they are free to creep. The girdles constitute a form of auxiliary adhesion device and are particularly useful where the tractor-tyre treads are past their prime.

Potato Digger

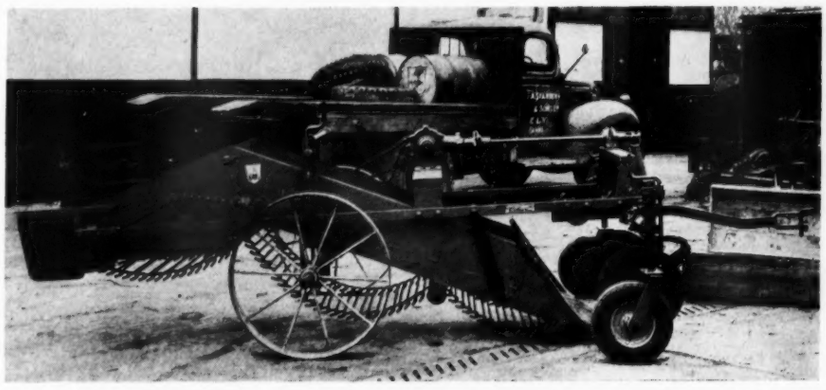
The Peter Standen potato digger (F. A. Standen and Sons Ltd., Hereward Works, Ely, Cambs, England) is designed to operate with maximum efficiency on all usual types of potato-growing lands. It is operated entirely by the tractor driver and it lifts, screens and deposits potatoes in windrows ready for bagging.

It is sturdily built with most wearing parts interchangeable with Standen beet harvester parts. It is semi-mounted and will hitch to most makes of tractors with p.t.-o. and PL.

The front carriage wheels run in line with lifting share, each wheel having independent screw adjustment. The rear axle has screw adjustments for levelling the machine. When the digger is lifted, the front carriage wheels and the disk coulter share all lift together, giving maximum manoeuvrability—the digger than trails on rear wheels. It has adjustable axle widths to suit row widths.

The Edge tractor-tyre girdle is a form of auxiliary adhesion device for use with tractor tyres. It is particularly useful if the tyres are in a worn condition

A ' Bulkfeed ' wagon can take on a complete load in times varying from 15 minutes to as little as a few seconds, depending on the nature of the load and the system used



The Standen potato digger is operated by the tractor driver; it lifts, screens and deposits potatoes in windrows ready for bagging

' Bulkfeed ' Wagon

The ' Bulkfeed ' wagon is claimed to be the first vehicle of its type in Britain to be completely designed for the bulk transport of animal feed. Based on an idea by Mr. Peter Sayer, of Lenwade Mills, Norwich, and developed in collaboration with Henry Simon Ltd., Cheadle Heath, Stockport, Cheshire, the wagon body is made by Mann, Egerton Ltd., of Norwich.

Chassis

The wagon was demonstrated mounted on a B.M.C. 7-ton chassis, but the 7-ton Bedford and Commer chassis are also suitable. Each of these chassis can be supplied with either petrol or diesel engines.

Body

The body, which is the key to the high payload of the wagon, is approximately 15 ft. × 7 ft., and the wagon has an overall laden height of 10 ft. 2 in.

A three-wire, insulated cable, carrying electricity from the 'Electrall' on the tractor to the motor on the baler, allows shorter turning than with mechanical p.t.-o. shaft

The body takes the form of four hoppers made in 16's gauge aluminium alloy, framed in alloy sections; the hoppers are separated by internal walls, and enable small unit loads to be carried.

Each hopper is provided with a weatherproof loading hatch in the roof. An access ladder at the rear of the vehicle and a walkway over the hatches allow the loading operation to be observed when necessary.

The hoppers slope down at the bottom to 10-in.-square slide valves, which can be easily operated and adjusted from the near side of the wagon.

Each hopper has a capacity of approximately 88 cu. ft., giving a maximum payload of 6 tons when all four hoppers are filled with cubes or pellets of average density.

On each side of the vehicle, beneath the hoppers, are side platforms for carrying the discharge pipes. They can also be used for carrying sack loads, although care must be taken to ensure that the combined weights of the bulk load and the sacks do not exceed the maximum permitted load of the wagon.

Discharging

Below the hoppers there is a large continuously bladed worm conveyor which transfers material to the rear of the vehicle. From an outlet at the end of the worm the cubes or pellets fall by gravity into a Simon pneumatic feeder. From the feeder, which is oil-free and thus cannot contaminate the products, the material is conveyed pneumatically through a pipeline to the customer's bin or, if the bin is at a considerable height, to the customer's intake pipeline. Tests have shown that breakage and dusting of pellets is negligible when handled in this way.

Air for the pneumatic conveying is supplied by a Rootes-type blower, which, together with the worm conveyor and the pneumatic feeder, is driven by a p.t.-o. from the main engine of the vehicle. A throttle control, pressure gauge and tachometer are situated near the blower. When the driver has connected the pipeline and set the appropriate slide valve, he can control the discharge from one central point.

A slipping clutch is provided in the main drive to prevent damage to the unloading equipment. A removable inspection window in the side of the worm conveyor casing allows the operator to watch the rate of discharge and permits him to set the slide valves accurately for different materials.

The wagon is normally loaded by gravity and is suitable for carrying cubes, pellets and various types of grain, any of which can be discharged at a rate of approximately 12 tons an hour through 30 or 40 ft. of 4-in.-dia. conveying piping. Each of the hoppers can, therefore, be discharged into the customer's receiving bin in a matter of minutes.

The Tilley infra-red heater requires little attention and is particularly suitable for poultry breeders

A 'First' for the 'Electrall'

International Harvester's 'Electrall' power system (International Harvester Export Company, 180 N. Michigan Avenue, Chicago 1, Ill, U.S.A.) received widespread attention recently at the national ploughing contest at Wabash, Indiana, U.S.A., when, for the first time, electric power for a radio broadcast was supplied by a farm tractor. The 'Electrall' was mounted on a Farmall 400 tractor and provided power for a tape recorder mounted on a platform above the tractor. The announcer was able to take his microphone and recording equipment wherever he thought he might find an interesting interview.

The 'Electrall' is being used to power electric tools, such as drills, saws, pumps and welding units, on locations beyond the reach of power lines. Mounted on a Farmall 400 or International W-400, it also operates a specially designed 10-h.p. motor for powering a hay baler, small combine and similar machines formerly requiring either a p.t.-o drive. from the tractor or a mounted engine.

Infra-red Heater

The Tilley infra-red heater (Tilley Lamp Co. Ltd., 70-72 Jermyn Street, London, S.W.1) is ideal for all who want a source of safe, beneficial, overhead heat, and particularly for the breeding of poultry and other livestock. The special long-lasting, metal-grid mantle is backed by a parabolic, highly polished, copper reflector to ensure maximum heat projection. An easily adjustable hanging bracket enables the heat to be thrown at varying angles. The extra large container ensures the minimum of attention over long hours of use, and it burns only 6 pints of paraffin (kerosene) in 48 hours.

WORLD CROP REPORTS

KENYA

Wheat

Recent heavy rains in Kenya have ruined wheat valued at £1 million, the Minister for Agriculture, Mr Michael Blundell, said here. The colony's wheat industry normally produced 1,400,000 bags annually he told the Nairobi branch of the Pharmaceutical Society of East Africa.

This year, because of six weeks of violent unseasonable rains, only one million bags could be expected.

The ruined wheat had shown it was highly susceptible to rust, he added.

FRANCE

Crop damage

Damage during the cold spell in February to French *wheat* crops ranged from 25% in Southern France to 70% in Northern France, according to the monthly crop report of the Ministry of Agriculture.

Of an area of 4,440,000 ha. under wheat, 2 million ha. have been destroyed and 1½ million ha. seriously affected. Wheat sown after 1 November had been particularly badly hit.

Barley had also suffered considerably, the report said. Out of an area of 400,000 ha. under autumn barley, it was believed that 200,000 ha. had been destroyed.

The Ministry said that 50% of the *oats* area was destroyed in Southern France, 95% in the north, and 55% in Western France. The Ministry put the total area destroyed at 350,000 ha. out of the 550,000 ha. sown to oats. *Rye* has suffered little from the frosts, but half of the oilseed acreage was lost because of the frost.

AUSTRALIA

Wheat

The Australian wheat harvest for the crop just gathered is estimated at 195,600,000 bushels under revised estimates completed by the Commonwealth Bureau of Census and Statistics.

This compared with the last estimate published at the end of January, when statisticians calculated that the crop would total 188,600,000 bushels. The latest estimate is about 27 million bushels more than in 1954–55.

Furthermore, the statisticians' survey points out that the yield is a new record per acre. Wheat is sown over 10,093,000 acres, with an expected average yield of 19.4 bushels to the acre. The previous record yield was 19.1 bushels per acre for the 1952–53 crop.

PAKISTAN

Jute

It was reported in the *Jute Bulletin* recently that a decision has been taken tentatively by the East Bengal Government to fix next season's area under jute in Pakistan at 1.671 million acres, which, it is estimated, will yield 5.5 million bales. Final decision on the matter rests with the Government in Karachi.

The proposed acreage for the coming season is about the same as has been fixed during the last seven years.

The home consumption of jute, which is nearly 650,000 bales, is expected to be increased next year with jute mills adopting double and more shifts.

Rice-crop estimate

The first estimate of the area under rice for the year 1955–56 is 22,900,000 acres, as against 22,782,000 acres reported in the first estimate of the previous year, and shows an increase of 0.5%. Major increases have occurred in the Peshawar, Lahore, Quetta and Bahawalpur Divisions of West Pakistan.

TANGANYIKA

The Department of Agriculture in Tanganyika has announced 'very serious' damage, particularly to *maize* and *rice* crops, in the Ruvuma and Tufija valleys of Southern Tanganyika following recent floods.

The crop in Tanganyika this year is now estimated at 70,000 tons of maize and 10,000 tons of hulled rice, compared with 126,500 tons and 20,000 tons respectively last year.

ENGLAND AND WALES

Agricultural report. Agricultural conditions in England and Wales on 1 March, 1956, have been summarised by the Ministry of Agriculture, Fisheries and Food.

The severe weather conditions were unfavourable for cultivations and sowing and virtually no progress was made during the month. Cereal crops were affected by frost in most areas. It is too soon to assess the extent of the damage, but some resowing will be necessary. Livestock have come through the trying weather quite well. Lowland ewes are, on the whole, in satisfactory condition; the condition of hill ewes is fair to good. Stocks of winter keep were heavily drawn on, but supplies remaining should be sufficient.

Weather conditions.—The weather during February was exceptionally cold, with severe frosts and considerable snow, particularly in some eastern, south-eastern and south-western areas. There were biting easterly winds over most of the country. Continuous frost was experienced in many places in England from 18 to 25 February. During the last two days of the month milder air spread over the country, bringing gales in many western and northern coastal districts and thunderstorms and hail in the north.

Cultivations and sowing.—Conditions were unfavourable for cultivations and sowing and virtually no progress was made during the month, but in many areas work was up to date, owing to good progress made earlier.

Autumn-sown crops.—Cereal crops were affected by frost in most areas, but generally it is too soon to assess the extent of damage. 'Lifting' is reported from several districts. Where crops have had a protective covering of snow serious damage is not expected, but many forward crops have been affected by frost and biting winds and some patching and resowing will be necessary. The area of autumn-sown *barley* and *oats* is not considerable, but these crops appear to have suffered much more damage than wheat. *Beans* for stock-feeding have been badly damaged and regarded as a total loss in some areas, but in several districts some recoveries are expected with the milder weather.

Pastures.—*Leys* were snow covered for most of the month in many areas and made no growth. Frost has caused some loss of leaf. In most districts it has not been possible to apply top-dressings and early grazing may be

two to four weeks late. Pigeons have damaged clovers in some districts.

Permanent pastures are generally bare and no growth was made during the month.

Winter keep.—*Kale* and other green crops were severely damaged by frost and pigeons. In some districts roots have been affected by frost. Stocks of winter keep were heavily drawn on during the month, but supplies remaining should normally be sufficient for the rest of the winter.

Potato stocks.—Very few clamps were opened during the month. It is too early to be certain of the effects of the frost, but reports indicate that little damage appears to have been done.

BELGIUM

Crop damage

Provisional estimates of Belgian crop losses due to the cold snap stand at 95,000 ha. of *wheat*, 6,000 ha. of *rye* and 20,000 ha. of *winter barley*, according to an announcement of M. René leFèvre, Minister of Agriculture.

The Minister said final damage estimates could not be given until the end of March.

Import licences for 6,000 tons of seed spring wheat for resowing had been granted, the Minister added.

CEYLON

Tea

Production of tea in Ceylon during December 1955 amounted to 31.3 million lb., which was some 2¼ million lb. less than in the corresponding month of 1954. This brings the total crop for 1955 to 380 million lb., the highest annual total recorded, and 13 million lb. more than in the previous record year, 1954.

Rubber

Production of rubber in Ceylon during 1955 amounted to 93,830 tons, compared with 93,935 tons in 1954 and 98,610 tons in 1953.

Sugar

The Government have plans for developing a sugar industry in Ceylon. Arrangements are being made for growing sufficient cane at Gal Oya to produce 30,000 tons of sugar annually. Subsequently additional acres will be devoted to growing sugar-cane. A plant is to be set up at Gal Oya to process the sugar-cane and tenders are to be invited within the next few months for the supply of the equipment.

Coconuts

The Government has decided to set up a new Coconut Rehabilitation Department to assist coconut pro-producers and smallholders by issuing subsidised seedlings and fertilisers, of both of which Government will bear one-third of the cost.

The annual rehabilitation target is 15,000 acres.

Salvinia campaign

The Department of Agriculture and Food are to spend Rs. 7 million on a drive to eradicate salvinia with the aid of a new weedicide produced by a U.K. firm. Salvinia is a rapidly spreading water weed, of which one root, imported from India for experimental purposes during the war, was carelessly discarded and the weed has now infested more than 30,000 acres of otherwise cultivable land.

U.S.A.

Small-grains

Autumn grains show continued improvement from the eastern part of Texas and Oklahoma and southern Missouri, eastward over the South Ohio valley, and north-east, owing to generally ample soil moisture and mostly favourable temperatures. Grains are high enough for grazing in the Gulf states and greening northward to the lower lake region, according to the U.S. Department of Commerce Weather Bureau report for the week ended 3 March.

Moderate to heavy rains fell from the middle Gulf area to the Carolinas, but precipitation was very light in the western Lake region and the upper Mississippi valley, where soil moisture is deficient.

In the middle and western great plains area, dry, sunny and windy weather and much above normal temperatures caused rapid depletion of limited topsoil moisture. Furthermore, warmth and sunshine stimulated crop development with its increased demand for moisture.

Some erosive wind damage was reported from the western portions of Nebraska, Kansas, Oklahoma and Texas and the eastern sections of Colorado and New Mexico. Kansas reports that wheat has greened up with considerable development of root systems, but with only limited top growth.

INTERNATIONAL

Sugar

France.—Production to 26 December, 1955 amounted to 1,444,472 metric tons, refined value. A final output for the 1955–56 season is estimated at about 1,470,000 tons.

French Morocco. — Experimental plots have been sown to sugar-beet but so far yields have been unsatisfactory.

Germany (West). — The 1955–56 sugar campaign in Western Germany has now drawn to a close. It is estimated that production in terms of raws amounted to about 1,275,245 metric tons, some 40,000 tons below the previous season's out-turn.

Taiwan.—It is understood that the Taiwan sugar crop this year will amount to about 770,000 metric tons. Taking into consideration the carry-over from last year it is felt that domestic requirements will take no more than 70,000 tons from the current crop, leaving 700,000 tons available for export.

U.S.S.R.—An excellent season has been experienced in the Ukraine, according to *Zeitschrift für die Zuckerindustrie*. The area under beet was increased by 117,000 ha. to 1,096,000 ha. and despite the worst-ever invasion of snout-beetle yields of beet per hectare were reported to be 45% better than the previous record.

Venezuela.—The remarkable expansion of the sugar industry in Venezuela continues and it is estimated that in 1956 production will amount to about 190,000 tons of refined sugar, some 50,000 tons in excess of domestic requirements, according to the Export Services Branch of the Board of Trade.

For the first time since 1940 prices have been reduced but even so they are considerably higher than those prevailing on the World Market and for the time being, at any rate, exports would appear to be impracticable.

Czarnikow Rev.